Appendix D

Preremediation Sampling Summary Report

CONTENTS

FIGURES

TABLES

ACRONYMS

CEL	Chemical Engineering Laboratory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFVAFS	cold vapor atomic fluorescence spectrometry
CFR	Code of Federal Regulations
DOE-ID	U.S. Department of Energy Idaho Operations Office
EPA	U.S. Environmental Protection Agency
ICDF	INEEL CERCLA Disposal Facility
ID	identification
INEEL	Idaho National Engineering and Environmental Laboratory
OU	operable unit
ROD	Record of Decision
TCLP	toxicity characteristic leaching procedure
TPR	technical procedure
WAG	waste area group

Preremediation Sampling Summary Report

D1. OVERVIEW

Preremediation sampling of the Central Facilities Area (CFA) -04 mercury pond was performed during the summer of 2002 in accordance with the *Field Sampling Plan for the Pre-Remediation Sampling of the Central Facilities Area-04 Pond* (DOE-ID 2002a). The governing quality assurance project plan for the sampling effort was the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 2002b). The primary purpose of the sampling effort was to refine the definition of the vertical extent of contamination to provide better direction for the remediation excavation effort. In addition, it was necessary to obtain additional data to determine the final treatment and/or disposal of contaminated soil to be excavated from the CFA-04 pond during the remedial activities. Finally, the data will be used to determine whether the assumptions used in calculating the preliminary remediation goals are valid.

D2. SITE BACKGROUND

D2.1 Site Description

The Idaho National Engineering and Environmental Laboratory (INEEL) is a government-owned/contractor-operated facility managed by the U.S. Department of Energy Idaho Operations Office (DOE-ID) and is located 51 km (32 mi) west of Idaho Falls, Idaho (Figure D-1). This facility occupies 2,305 km^2 (890 mi^2) of the northeastern portion of the Eastern Snake River Plain and encompasses portions of five Idaho counties: (1) Butte, (2) Jefferson, (3) Bonneville, (4) Clark, and (5) Bingham.

The CFA has been used since 1949 to house many of the support services for all of the operations at the INEEL. These support services include laboratories, security operations, fire protection, medical facilities, communication systems, warehouses, a cafeteria, vehicle and equipment pools, the bus system, and laundry facilities. The *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991) identified 52 potential release sites at CFA, which were designated as Waste Area Group (WAG) 4. The types of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites at WAG 4 include landfills, underground storage tanks, aboveground storage tanks, dry wells, disposal ponds, soil contamination sites, and a sewage plant. Each of these sites was placed into one of 13 operable units (OUs) within the WAG, based on similarity of contaminants, environmental release pathways, and/or investigations.

The CFA-04 pond is a shallow, unlined surface depression that was originally a borrow pit for construction activities at CFA (Figure D-2). The pond is approximately 46 × 152 m (150 × 500 ft) and roughly 2 to 2.4 m (7 to 8 ft) deep. Basalt outcrops are present within, and immediately adjacent to, the pond. It received laboratory waste from the Chemical Engineering Laboratory (CEL) in Building CFA-674 between 1953 and 1969. The CEL was used to conduct calcine experiments on simulated nuclear waste. The calcining process was later used on actual nuclear waste at the INEEL to change the waste from a liquid to a solid, thereby reducing the overall waste. The CEL experiments used mercury to dissolve simulated aluminum fuel cladding as well as radioisotope tracers in the calcining process. The primary waste streams discharged to the pond from the CEL included approximately 76.5 m^3 (100 yd^3) of mercury-contaminated calcine that contained low-level radioactive waste and liquid effluent from the laboratory experiments. In addition, there is approximately 382 m^3 (500 yd^3) of rubble consisting of laboratory bottles, asphalt and asbestos roofing materials, reinforced concrete, and construction and demolition debris. The pond received run-off from the CFA site periodically between 1953 and 1995.

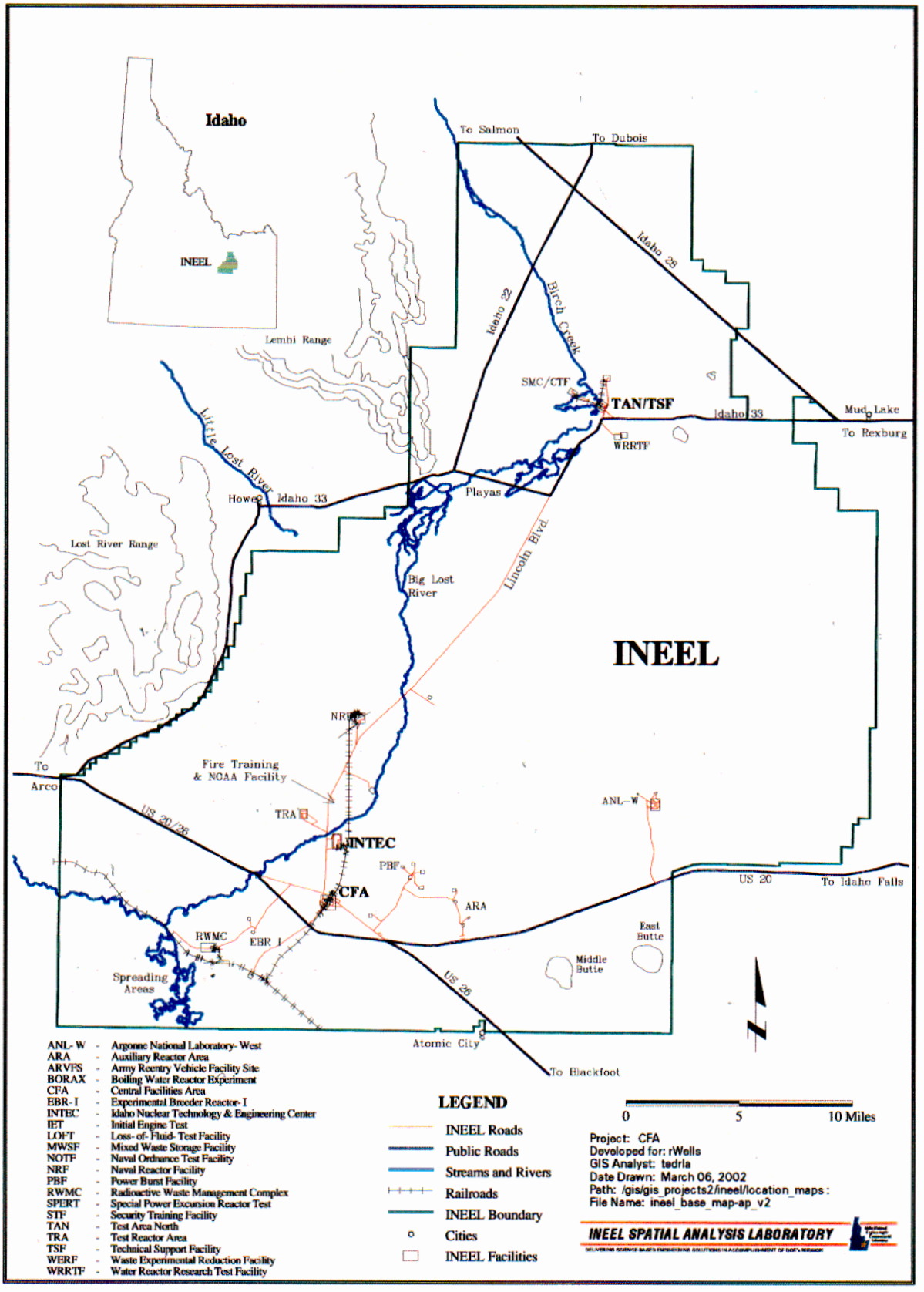

Figure D-1. Idaho National Engineering and Environmental Laboratory.

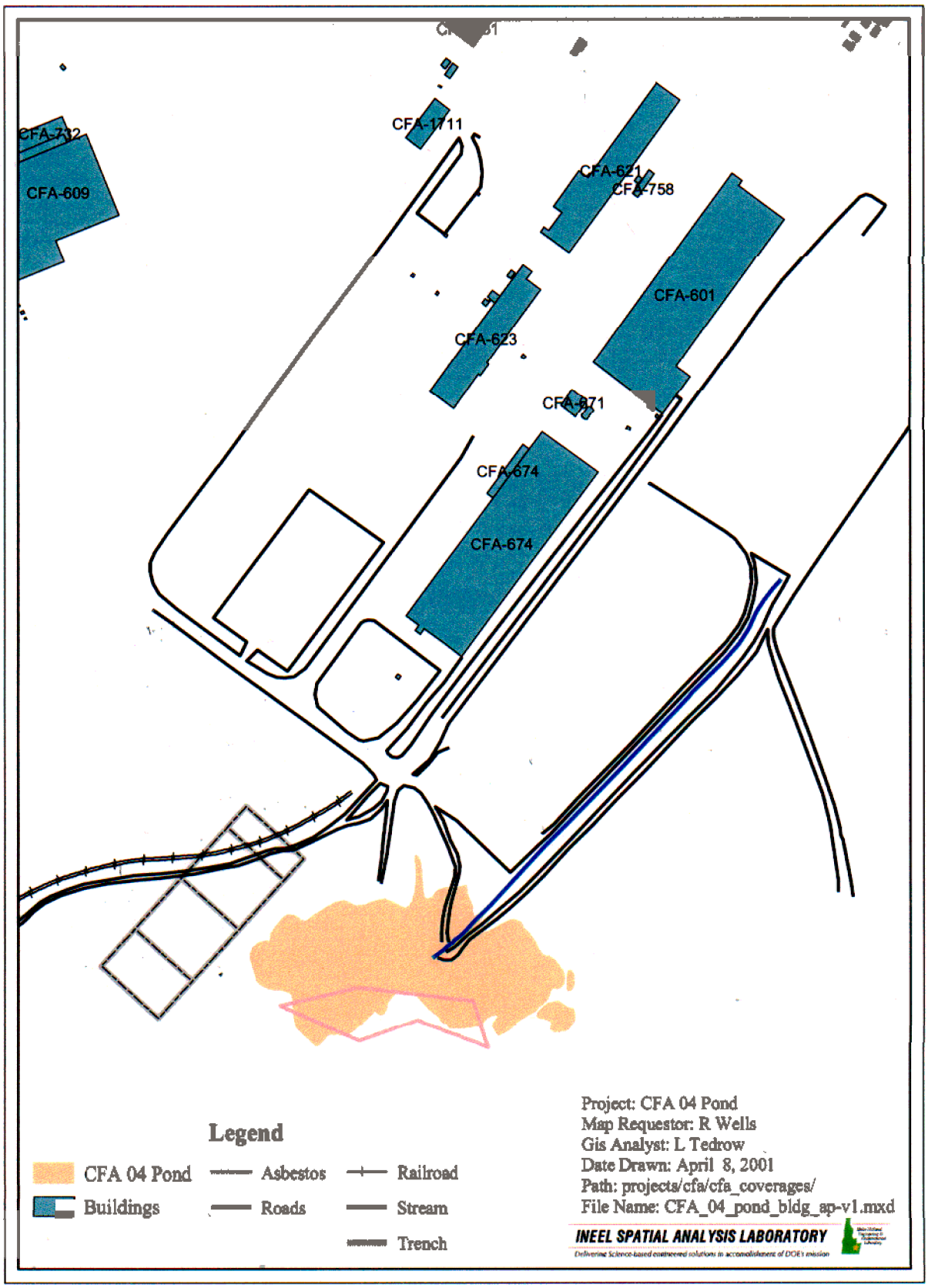

Figure D-2. The CFA-04 pond.

D2.2 Nature and Extent of Contamination

The CFA-04 pond was identified as a Track 2 investigation site in the Federal Facility Agreement and Consent Order (DOE-ID 1991). In 1994, visual inspections revealed the presence of calcine on the bermed areas around the periphery of the pond. After surface and subsurface soil data collection from the calcine and the pond berm in early and mid-1994, a time-critical removal action in September 1994 excavated approximately 218 m^3 (285 yd^3) of calcine and calcine-contaminated soil and a small amount of asbestos from the bermed area. The soil was remediated at a portable retort setup northeast of the pond. Verification soil sampling conducted after the removal action showed that, with the exception of one location having a mercury concentration of 233 mg/kg, the bermed areas had residual mercury concentrations less than the final remediation goal of 8.4 mg/kg (DOE-ID 2000a).

The *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13* (DOE-ID 2000b) originally established a final remediation goal of 0.5 mg/kg for mercury contamination at CFA-04. This was an ecological goal based on 10 times the average background concentration for composite samples. After new information became available from U.S. Environmental Protection Agency (EPA) sources, it was determined that a reevaluation of the final remediation goal for mercury was warranted for both human and ecological receptors. Based on this new information, hazard quotients were recalculated for the existing concentration of mercury at the CFA-04 pond. For the future residential exposure scenario, the recalculated hazard quotient is 7.56 as compared to 80 from the Record of Decision (ROD) (DOE-ID 2000b). For the ecological risk assessment, the recalculated values are <1 to 210 as compared to <1 to 30,000 from the ROD (DOE-ID 2000b). Based on this new information, the recalculated remediation goals for ecological and human health risk are 8.4 mg/kg and 9.4 mg/kg, respectively. The recalculated remediation goals for both human health and ecological receptors are consistent with the remedial action objectives for the CFA-04 pond. This information is presented in more detail in the *Explanation of Significant Differences to the Record of Decision for the Central Facilities Area, Operable Unit 4-13* (DOE-ID 2003).

During the 1995 Track 2 investigation, additional soil samples were collected from the pond inlet area and a deeper area of the pond near the inlet where laboratory effluent might have collected. The results of the 1994 and 1995 soil investigations revealed that concentrations of the following constituents exceeded background concentrations for the INEEL: aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, lead, magnesium, mercury, nickel, Cs-137, Pa-234m, Sr-90, Th-234, U-234, U-235, and U-238. Aroclor-1254 also was detected at low levels. Preliminary risk screening indicated that the following constituents detected at the pond posed potential human health risks: aroclor-1254, arsenic, mercury, Cs-137, U-234, U-235, and U-238. The range of detected concentrations of these analytes is presented in Table D-1. Based on these data, the site was recommended in the *Preliminary Scoping Track 2 Summary Report for Operable Unit 4-05* (Blackmore, Peatross, and Stepan 1996) for further characterization in the *Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2000a).

Table D-1. Range of detected concentrations.

Analyte	Range of Detected Concentrations
Arsenic	3.1 to 22.4 mg/kg
Mercury	0.12 to 439 mg/kg
Cs-137	0.0742 to 2 pCi/g
U-234	0.651 to 22.6 pCi/g
U-235	0.0225 to 1.6 pCi/g
U-238	0.73 to 35 pCi/g

During 1997 and 1998, additional soil samples were collected for the OU 4-13 Remedial Investigation/Feasibility Study at four areas along the length of the pipe connecting the CEL to the pond, in the area northeast of the pond known as the windblown area, and from the pond bottom. Data from these investigations confirmed the presence of mercury in these areas at concentrations up to 439 mg/kg (DOE-ID 1992). Four of the 88 samples exceeded the mercury Resource Conservation and Recovery Act characteristic hazardous waste level of 0.2 mg/L. Three of the four samples were in close proximity to one another in the pond, and the fourth was an isolated occurrence in the windblown area and was eliminated. A contour line was drawn around the three closely spaced samples and the area was estimated. The depth of the soil in the pond conservatively was estimated to be 2.4 m (8 ft) in the pond bottom and 0.15 m (0.5 ft) in the windblown area, indicating that approximately 612 m^3 (800 yd^3) of soil is potentially characteristic waste in accordance with the Resource Conservation and Recovery Act and is subject to land disposal restrictions upon excavation.

During the summer of 2002, sampling was performed within the contours of the pond and at selected areas outside the pond that were determined, based on historical analytical data, to contain higher mercury concentrations. This sampling was performed to further refine the vertical extent of contamination to provide better direction for the remediation excavation effort. The collection of samples also served to determine the final treatment and/or disposal options for the contaminated soil excavated from the pond and to determine whether the assumptions used in calculating the final remediation goals were valid.

The only contaminant that poses an unacceptable risk to human health and the environment is mercury. Mercury-contaminated soil is present in the pond bottom, around the pond periphery in the berms, along the pipe connecting the CEL to the pond, and in the area northeast of the pond as a result of windblown contamination. This contamination encompasses an area approximately 91 × 183 m (300 × 600 ft). The OU 4-13 Remedial Investigation/Feasibility Study (DOE-ID 2000a) conservatively estimated the volume of mercury-contaminated soil to be approximately 6,338 m^3 (8,290 yd^3), based on the dimensions of the pond bottoms, windblown area, and pipeline at depths of 2.4 m (8 ft), 0.15 m (0.5 ft), and 1.8 m (6 ft), respectively. This volume was calculated using the extent of contamination based on the original final remediation goal of 0.50 mg/kg for total mercury as stated in the ROD (DOE-ID 2000b). The final volume could differ based on the revised final remediation goal of 8.4 mg/kg and actual conditions encountered in the field.

D2.3 Project Description

Significant data previously have been collected defining much of the areal and vertical extent of mercury contamination in the CFA-04 pond (refer to the Field Sampling Plan, Appendix A [DOE-ID 2002a]). Particularly, adequate information is available detailing the contamination levels in the pond's surficial soil, much of the bermed area, and the surficial soil in the windblown area. However, data gaps still exist in the definition of the vertical extent of contamination in the pond area and the bermed area along the southern edges of the pond. Additional sampling for mercury analysis was deemed necessary to aid in soil excavation during the remedial action in an effort to minimize the volume of contaminated soil requiring disposal.

Chromium and silver have been detected in soil samples collected from the pond at maximum concentrations of 237 mg/kg and 121 mg/kg, respectively. Applying the 20X rule of dilution to the total metal results provides a conservative estimate of 11.8 mg/L and 6.0 mg/L, respectively, both of which exceed the characteristic limits of 6.0 mg/L for both chromium and silver. Therefore, it was necessary to determine whether any of the soils to be remediated for mercury contamination are characteristic for either chromium or silver, as this will affect the final disposal pathway.

Likewise, there is some soil that exceeds background concentrations for radionuclides. If soil exceeds background concentrations for radionuclides, then it must be disposed of at the INEEL CERCLA Disposal Facility (ICDF); otherwise, it can be disposed of at the CFA landfill. If the soil also exceeds the 260-mg/kg regulatory limit for mercury, then the soil would require off-Site treatment by retort (40 CFR 268.40, "Applicability of Treatment Standards").

As it is the intent of the CFA-04 project to dispose of the contaminated soil at the ICDF, data were required to support the waste acceptance criteria for that facility. The data generated from this sampling effort will be used to define a three-dimensional representation of the contamination zones within the CFA-04 pond. The data ultimately will be used to direct the soil excavation during the remedial action. This three-dimensional representation will describe the vertical extent of contamination within each zone defined in the Field Sampling Plan (DOE-ID 2002a), thereby allowing the project to determine the required excavation depth within the areal boundary of a zone.

Lastly (as previously described), the final remediation goal was reevaluated with 8.4 mg/kg total mercury being defined as the cleanup goal based on ecological risk. The primary risk due to mercury is attributed to the presence of methyl mercury. It must be determined whether the concentrations of methyl mercury in the pond are less than or equal to those used in calculating the ecological risk. If the methyl mercury concentrations are greater, then the final remediation goal may need to be revisited.

D3. SAMPLING LOCATIONS

Samples were collected representing 30-cm (1-ft) intervals. As an example, the basalt underlying a given zone may be 1.83 m (6 ft) deep. Four cores were collected within the zone, and samples of each core were collected from 0 to 30 cm (0 to 1 ft), 30 to 61 cm (1 to 2 ft), 61 to 91 cm (2 to 3 ft), 91 cm to 1.22 m (3 to 4 ft), 1.22 to 1.52 m (4 to 5 ft), and 1.52 to 1.83 m (5 to 6 ft). The 0- to 30-cm (0- to 1-ft) samples of each core were combined to provide one composite analytical sample that was submitted to the laboratory, as were the samples from each of the other depth intervals. Only the cores that reached a given depth interval were used to form the composite analytical sample for that interval. For example, if two cores reached a depth of 2.44 m (8 ft), those two cores were used to create the composite sample for that depth.

For sampling purposes, the CFA-04 pond area was subdivided into 15 zones (see Figure D-3). The zones were defined based on the source of contamination and similarity of mercury concentrations from historical sampling events. For all zones within the pond area, the sources of contamination were assumed to be waste calcine disposed of to the pond, as well as mercury-containing waste water that was pumped to the pond and allowed to percolate down through the pond sediments. Figure D-3 graphically delineates the sampling zones and the four core locations originally proposed within each zone.

D4. SAMPLING REQUIREMENTS

As shown in Figure D-2, the area sampled was subdivided into zones. Each zone required four core samples with each core sample collected from the surface until the auger met refusal at the basalt interface. The basalt underlying the pond is fairly undulating—ranging in depth from the basalt outcroppings visible on the southern edge of the pond to an approximate depth of 3 m (10 ft) in a few locations. Following the collection of the core, samples were subdivided from the core at set intervals. The analytical sample submitted to the laboratory consisted of a composite of the individual core samples collected from a discrete depth within a given zone.

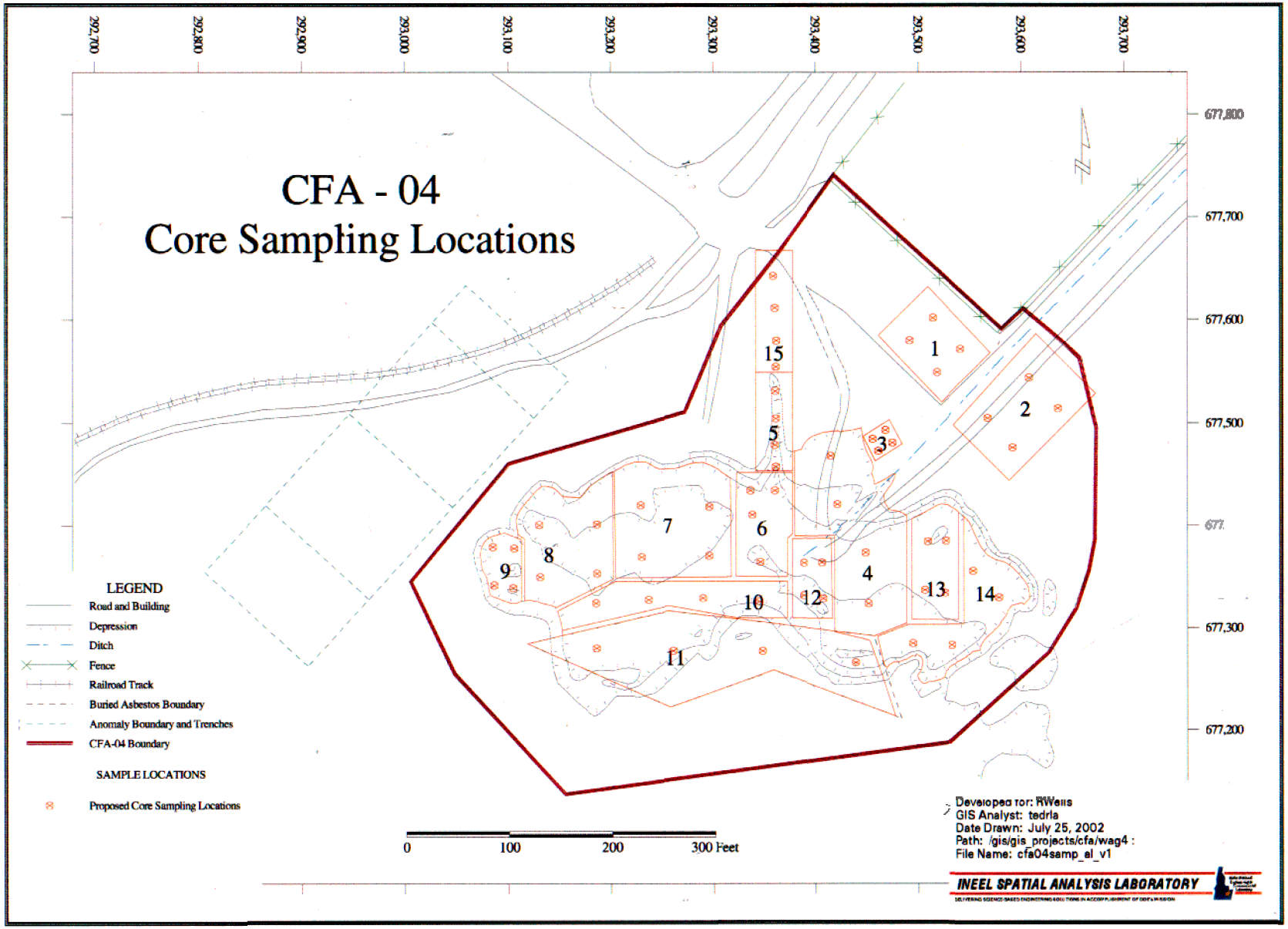

Figure D-3. The CFA-04 sampling locations.

Samples were collected following the procedures delineated in Technical Procedure (TPR) -6559, "Sampling with a Hollow-Stem Auger," as well as the requirements set forth in the subcontractor's scope of work and specifications. Much of the area sampled previously had been covered with a 15- to 30-cm (6- to 12-in.) layer of gravel. Before sampling at a given location, the gravel layer was removed by hand digging prior to using the drill auger. The gravel layer did not require sampling, since it was emplaced in 2001 as a fire mitigation method and was not contaminated in the same manner as the pond sediments.

The auger was equipped with a core catcher, a split inner barrel, and a Lexan liner. Initially, the auger was advanced approximately 0.9 m (3 ft) or until refusal, whichever occurred first. Because the core recoveries were poor for the initial sampling zones (1 and 2), a different sampling approach was taken for the subsequent zones. For Zones 3 through 15, the first 0- to 0.3-m (0- to 1-ft) interval was augered by hand, followed by mechanically augering in 0.3-m (1-ft) increments.

When mechanically augering, the inner split barrel was recovered with a wireline and the liner was retrieved. After removing the inner barrel shoe and head, both ends of the liner were capped and taped for delivery to the sampling team. A new liner was installed inside an inner barrel with associated ends and inside augers. The next 0.9-m (3-ft) section of the borehole was augered with these steps, continuing until refusal was encountered at the basalt interface. After the final core section was removed from the borehole, the borehole was backfilled with residual sample material or uncontaminated gravel or sand.

The sampling team collected individual sample aliquots using disposable sampling spoons. The aliquots were placed in certified, precleaned sample containers with an appropriate sample label affixed that had been obtained from Sampling and Analysis Management (formerly the Sample Management Office). Refer to Table D-2 for the specific sample analytical requirements.

Table D-2. Specific sample analytical requirements.

Analytical Parameter	Analytical Method
Hg/Cr/Ag	SW-846 Method 7000 series
Toxicity characterization leaching procedure Hg/Cr/Ag	SW-846 Method 1311/ 7000 series
Radionuclides	
Uranium isotopes	Alpha spectrometry
Strontium-90	Gas-flow proportional counting
Gamma-emitting isotopes	Gamma spectrometry
Methyl mercury	EPA Method 1630

EPA = U.S. Environmental Protection Agency

D4.1 Methyl Mercury Analytical Method

The samples were analyzed according to a modified version of EPA Method 1630, "Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and CVAFS (Draft)."[a] The EPA method was modified by leaching methyl mercury into a solution of KBr, H_2SO_4, and $CuSO_4$ and

a. EPA, 1998, "Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and CVAFS (Draft)," Method 1630, U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, Engineering and Analysis Division, Washington, D.C., August 1998.

extracting it with CH_2CI_2—as was done by Bloom, Colman, and Barber (1997)—instead of steam distillation. The prescribed distillation technique would not work on these samples. The method also was modified for the analysis of methyl mercury by using purge and trap/gas chromatography/cold vapor atomic adsorption instead of cold vapor atomic fluorescence spectrometry (CVAFS). The extract was ethylated according to EPA Method 1630. The details of the steps performed are included in Attachment 1.

D5. ANALYTICAL RESULTS

The following subsections summarize the sampling and analysis results for each of the 15 zones delineated in Figure D-3. A discussion is provided pertaining to the depth of individual core samples within each zone with the analytical results summarized for each depth sampled within the zone.

D5.1 Sampling Zone 1

Four coreholes were drilled in Sampling Zone 1, ranging from 3.5 to greater than 3.7 m (11.5 to 12 ft). Three of the four coreholes were drilled to a depth greater than 3.66 m (12 ft); however, samples only were collected from the 0.3-m (1-ft) intervals down to the 3.7-m (12-ft) depth.

- Corehole 1-A-1
  - Depth—3.5 m (11.5 ft)
  - No sample was recovered for the 0.6- to 0.9-m (2- to 3-ft), 0.9- to 1.2-m (3- to 4-ft), and 2.7- to 3.0-m (9- to 10-ft) intervals
- Corehole 1-B-2
  - Depth—4.9 m (16 ft)
  - No sample was recovered for the 0.6- to 0.9-m (2- to 3-ft) and 1.5- to 1.8-m (5- to 6-ft) intervals
- Corehole 1-C-3
  - Depth—>3.7 m (12 ft)
  - No sample was recovered for the 0.9- to 1.2-m (3- to 4-ft), 1.2- to 1.5-m (4- to 5-ft), and 1.5- to 1.8-m (5- to 6-ft) intervals
- Corehole 1-D-4
  - Depth—>3.7 m (12 ft)
  - Full recovery occurred at all depths.

The analytical results for Sample Zone 1 are presented in Table D-3. Samples were analyzed for radionuclides (including gamma-emitting isotopes, strontium-90, and uranium isotopes), total mercury, and toxicity characteristic leaching procedure (TCLP) metals (including chromium, mercury, and silver). In addition, one sample collected from the 0- to 0.3-m (0- to 1-ft) interval also was analyzed for methyl mercury. As can be seen from the analytical results, none of the total mercury analytical results exceeded the final remediation goal of 8.4 mg/kg. Likewise, none of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24, "Toxicity Characteristic." Concentrations of uranium isotopes are in line with what would be expected naturally. Cesium-137 was detected in one sample collected from the 0- to 0.3-m (0- to 1-ft) interval; however, the concentration is less than the 95% upper confidence level of 0.82 pCi/g for soil surrounding the INEEL that is attributed to fallout from aboveground nuclear testing. Radium-226 was detected by gamma spectrometry at all intervals at concentrations slightly elevated above what would be expected naturally. However, the results should be viewed with some caution because of the possible interference with the detection of Ra-226 by gamma spectrometry due to the presence of U-235. Similar to Cs-137, Sr-90 was detected in the 0- to 0.3-m (0- to 1-ft) interval; however, the detected concentration is below the 95% upper confidence level of 0.49 pCi/g for background concentrations. The methyl mercury concentration was below the laboratory method detection limit of 0.005 mg/kg.

D5.2 Sampling Zone 2

Four coreholes were drilled in Sampling Zone 2, ranging from 3.1 m (10 ft 2 in.) to greater than 3.4 m (11 ft). Three of the four coreholes were drilled to a depth greater than 3.4 m (11 ft); however, samples only were collected from the 0.3-m (1-ft) intervals down to the 3.4-m (11-ft) depth.

- Corehole 2-A-5
  - Depth—>3.4 m (11 ft)
  - Full recovery occurred at all depths
- Corehole 2-B-6
  - Depth—>3.4 m (11 ft)
  - 20 to 25 cm (8 to 10 in.) recovery at most intervals and only 18 cm (7 in.) at the 0.6- to 0.9-m (2- to 3-ft) interval
- Corehole 2-C-7
  - Depth—3.1 m (10 ft 2 in.)
  - No sample was recovered for the 0.9- to 1.2-m (3- to 4-ft) and 3.0- to 3.4-m (10- to 11-ft) intervals
- Corehole 2-D-8
  - Depth—>3.4 m (11 ft)
  - No sample was recovered for the 0.6- to 0.9-m (2- to 3-ft) interval.

Table D-3. Sampling Zone 1 analytical results.

Sample ID:	4P4001		4P4002		4P4003		4P4004		4P4005		4P4006	
Interval (ft):	0–1.0		1.0–2.0		2.0–3.0		3.0–4.0		4.0–5.0		5.0–6.0	
Gamma spectrometry (pCi/g)												
Cs-137	2.05 +/- 0.27 E-01		<0.0730		<0.0809		<0.0809		<0.0559		<0.0959	
Ra-226	2.59 +/- 0.43 E+00		2.82 +/- 0.55 E+00		2.97 +/- 0.45 E+00		2.90 +/- 0.58 E+00		3.43 +/- 0.50 E+00		3.68 +/- 0.63 E+00	
Sr-90 (pCi/g)	1.98 +/- 0.61 E-01		<0.218		<0.206		<0.195		<0.476		<0.422	
Uranium isotope (pCi/g)												
U-234	1.06 +/- 0.08 E+00		9.19 +/- 0.75 E-01		1.04 +/- 0.08 E+00		1.10 +/- 0.09 E+00		1.18 +/- 0.09 E+00		1.44 +/- 0.11 E+00	
U-235	1.03 +/- 0.16 E-01		1.54 +/- 0.21 E-01		1.37 +/- 0.20 E-01		1.37 +/- 0.21 E-01		1.41 +/- 0.20 E-01		2.30 +/- 0.28 E-01	
U-238	1.08 +/- 0.08 E+00		9.95 +/- 0.80 E-01		1.05 +/- 0.08 E+00		1.08 +/- 0.09 E+00		1.14 +/- 0.09 E+00		1.40 +/- 0.11 E+00	
Mercury (mg/kg)	1.9		0.14		0.05		0.08		0.06		0.11	
TCLP metals (µg/L)												
Chromium	3.1	B	1.6	B	12.7		2.2	B	1.7	B	1.3	B
Mercury	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Silver	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
Methyl mercury (mg/kg)	0.005	U	NA		NA		NA		NA		NA	

Sample ID:	4P4007		4P4008		4P4009		4P4010		4P4011	
Interval (ft):	6.0–7.0		7.0–8.0		8.0–9.0		9.0–10.0		10.0–11.0	
Gamma spectrometry (pCi/g)										
Cs-137	<0.0812		<0.0634		<0.0884		<0.0586		<0.0592	
Ra-226	2.74 +/- 0.58 E+00		2.07 +/- 0.46 E+00		3.25 +/- 0.84 E+00		1.71 +/- 0.42 E+00		1.85 +/- 0.40 E+00	
Sr-90 (pCi/g)	<0.405		<0.420		<0.437		<0.406		<0.425	
Uranium isotope (pCi/g)										
U-234	1.33 +/- 0.10 E+00		1.25 +/- 0.10 E+00		1.07 +/- 0.09 E+00		8.42 +/- 0.70 E-01		8.59 +/- 0.71 E-01	
U-235	2.29 +/- 0.28 E-01		2.29 +/- 0.28 E-01		1.05 +/- 0.17 E-01		9.06 +/- 1.57 E-02		1.68 +/- 0.22 E-01	
U-238	1.18 +/- 0.09 E+00		1.14 +/- 0.09 E+00		1.06 +/- 0.08 E+00		8.42 +/- 0.70 E-01		8.95 +/- 0.74 E-01	
Mercury (mg/kg)	0.02	B	0.03	B	0.02	B	0.02	U	0.02	U
TCLP metals (µg/L)										
Chromium	1.00	B	1.3	B	1.2	B	1.8	B	1.9	B
Mercury	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Silver	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
Methyl mercury (mg/kg)	NA		NA		NA		NA		NA	

TCLP = toxicity characteristic leaching procedure

The analytical results for Sample Zone 2 are presented in Table D-4. Samples were analyzed for radionuclides (including gamma-emitting isotopes, strontium-90, and uranium isotopes), total mercury, and TCLP metals (including chromium, mercury, and silver). In addition, samples collected from the 0- to 0.3-m (0- to 1-ft) and 0.3- to 0.6-m (1- to 2-ft) intervals also were analyzed for methyl mercury. As can be seen from the data, the only interval for which the mercury concentration exceeded the final remediation goal of 8.4 mg/kg was the 0- to 0.3-m (0- to 1-ft) interval. None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24. The uranium isotopic concentrations are consistent with those found naturally occurring, with the possible exception of the 1.5- to 1.8-m (5- to 6-ft) interval wherein the concentrations slightly exceeded the 95% upper confidence levels of 1.44 pCi/g and 1.40 pCi/g for U-234 and U-238, respectively. Radium-226 was detected by gamma spectrometry at all intervals, with the exception of the 1.5- to 1.8-m (5- to 6-ft) interval. The concentrations are slightly elevated above what would be expected naturally. However, the results should be viewed with some caution because of the possible interference with the detection of Ra-226 by gamma spectrometry due to the presence of U-235. Strontium-90 was not detected in any of the samples collected. The methyl mercury concentrations in the two samples (one sample and one duplicate) were below the laboratory method detection limit of 0.005 mg/kg.

D5.3 Sampling Zone 3

Four coreholes were drilled in Sampling Zone 3, ranging from 2.4 m (8 ft) to more than 2.4 m (8 ft). Three of the four coreholes were drilled to a depth greater than 2.4 m (8 ft); however, samples only were collected from the 0.3-m (1-ft) intervals down to the 2.4-m (8-ft) depth.

- Corehole 3-A-9
  - Depth—2.4 m (8 ft)
  - No sample was recovered for the 2.1- to 2.4-m (7- to 8-ft) interval
- Corehole 3-B-10
  - Depth—>2.4 m (8 ft)
  - No samples were recovered for the 1.8- to 2.1-m (6- to 7-ft) and 2.1- to 2.4-m (7- to 8-ft) intervals
- Corehole 3-C-11
  - Depth—>2.4 m (8 ft)
  - No samples were recovered for the 0.3- to 0.6-m (1- to 2-ft), 0.9- to 1.2-m (3- to 4-ft), 1.6- to 1.8-m (5- to 6-ft), and 1.8- to 2.1-m (6- to 7-ft) intervals
- Corehole 3-D-12
  - Depth—>2.4 m (8 ft)
  - No samples were recovered for the 0.9- to 1.2-m (3- to 4-ft), 1.2- to 1.5-m (4- to 5-ft), and 2.1- to 2.4-m (7- to 8-ft) intervals.

Table D-4. Sampling Zone 2 analytical results.

Sample ID:	4P4012		4P4012		4P4013		4P4014		4P4015		4P4016	
Interval (ft):	0–1.0		0–1.0		1.0–2.0		2.0–3.0		3.0–4.0		4.0–5.0	
Gamma spectrometry (pCi/g)												
Ra-226	2.54 +/- 0.48 E+00		1.92 +/- 0.61 E+00		2.49 +/- 0.52 E+00		1.32 +/- 0.38 E+00		2.50 +/- 0.48 E+00		2.22 +/- 0.38 E+00	
Sr-90 (pCi/g)	<0.189		<0.174		<0.184		<0.181		<0.197		<0.209	
Uranium isotope (pCi/g)												
U-234	9.06 +/- 0.73 E-01		8.60 +/- 0.69 E-01		1.01 +/- 0.08 E+00		9.89 +/- 0.78 E-01		1.15 +/- 0.09 E+00		1.23 +/- 0.09 E+00	
U-235	6.80 +/- 1.41 E-02		9.10 +/- 1.50 E-02		6.73 +/- 1.52 E-02		7.76 +/- 1.50 E-02		1.21 +/- 0.18 E-01		1.14 +/- 0.18 E-01	
U-238	1.05 +/- 0.08 E+00		1.05 +/- 0.08 E+00		1.08 +/- 0.09 E+00		1.16 +/- 0.09 E+00		1.23 +/- 0.09 E+00		1.19 +/- 0.09 E+00	
Mercury (mg/kg)	8.8		2.5		2.4		0.90		0.84		0.24	
TCLP metals (µg/L)												
Chromium	0.85	B	0.99	B	1.5	B	2	B	11.8		1.1	B
Mercury	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Silver	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
Methyl mercury (mg/kg)	0.005	U	0.005	U	NA		NA		NA		NA	

Sample ID:	4P4017		4P4018		4P4019		4P4020		4P4021		4P4022	
Interval (ft):	5.0–6.0		6.0–7.0		7.0–8.0		8.0–9.0		9.0–10.0		10.0–11.0	
Gamma spectrometry (pCi/g)												
Ra-226	<1.40		2.39 +/- 0.46 E+00		2.62 +/- 0.48 E+00		2.67 +/- 0.50 E+00		2.68 +/- 0.50 E+00		1.98 +/- 0.40 E+00	
Sr-90 (pCi/g)	<0.159		<0.190		<0.187		<0.176		<0.194		<0.186	
Uranium isotope (pCi/g)												
U-234	1.56 +/- 0.12 E+00		1.33 +/- 0.10 E+00		1.14 +/- 0.09 E+00		1.16 +/- 0.09 E+00		1.13 +/- 0.09 E+00		1.12 +/- 0.08 E+00	
U-235	1.10 +/- 0.18 E-01		5.36 +/- 1.22 E-02		9.72 +/- 1.77 E-02		8.04 +/- 1.59 E-02		4.91 +/- 1.30 E-02		6.99 +/- 1.32 E-02	
U-238	1.51 +/- 0.11 E+00		1.30 +/- 0.10 E+00		1.26 +/- 0.10 E+00		1.12 +/- 0.09 E+00		1.05 +/- 0.09 E+00		9.91 +/- 0.76 E-01	
Mercury (mg/kg)	0.17		0.05		0.04		0.03	B	0.02	B	0.02	B
TCLP metals (µg/L)												
Chromium	0.80	U	0.80	U	0.82	B	5.2		0.80	U	0.80	U
Mercury	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Silver	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
Methyl Mercury (mg/kg)	NA		NA		NA		NA		NA		NA	

TCLP = toxicity characteristic leaching procedure

The analytical results for Sample Zone 3 are presented in Table D-5. Samples were analyzed for total mercury and TCLP metals (including chromium, mercury, and silver). As can be seen from the data, none of the mercury concentrations from any of the intervals exceeded the final remediation goal of 8.4 mg/kg. In addition, none of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-5. Sampling Zone 3 analytical results.

Sample ID:	Interval (ft):	Mercury (mg/kg)	TCLP Metals (µg/L)					
			Chromium		Mercury		Silver	
4P402301	0–1.0	2.9	1.6	B	1.0	U	1.8	U
4P402401	1.0–2.0	2.7	3.6	B	1.0	U	1.8	U
4P402501	2.0–3.0	0.21	1.8	B	1.0	U	1.8	U
4P402601	3.0–4.0	0.08	1.7	B	1.0	U	1.8	U
4P402701	4.0–5.0	0.05	1.4	B	1.0	U	1.8	U
4P402801	5.0–6.0	0.04	1.6	B	1.0	U	1.8	U
4P402901	6.0–7.0	0.05	1.4	B	1.0	U	1.8	U
4P403001	7.0–8.0	0.06	2.0	B	1.0	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D5.4 Sampling Zone 4

Four coreholes were drilled in Sampling Zone 4, ranging from 0.8 m (2.5 ft) to 2.4 m (8 ft). Samples were collected from the 0.3-m (1-ft) intervals down to the 2.4-m (8-ft) depth.

- Corehole 4-A-13
  - Depth—2.4 m (8 ft)
  - Full recovery of all intervals occurred from 0 to 2.1 m (0 to 7 ft) with 75 cm (9 in.) recovered from the 2.1- to 2.4-m (7- to 8-ft) interval
- Corehole 4-B-14
  - Depth—2.4 m (8 ft)
  - Full recovery of all intervals occurred from 0 to 2.4 m (0 to 8 ft)
- Corehole 4-C-15
  - Depth—2.2 m (7 ft 1 in.)
  - Full recovery of all intervals occurred from 0 to 2.1 m (0 to 7 ft)
- Corehole 4-D-16
  - Depth—0.8 m (2.5 ft)
  - Full recovery of all intervals occurred from 0 to 0.8 m (0 to 2.5 ft).

The analytical results for Sample Zone 4 are presented in Table D-6. Samples were analyzed for total mercury and TCLP metals (including chromium, mercury, and silver). As can be seen from the data, none of the mercury concentrations from any of the intervals exceeded the final remediation goal of 8.4 mg/kg. In addition, none of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-6. Sampling Zone 4 analytical results.

Sample ID:	Interval (ft):	Mercury (mg/kg)		TCLP Metals (µg/L)					
				Chromium		Mercury		Silver	
4P403101	0–1.0	2.1		2.3	B	1.2	B	1.8	U
4P403201	1.0–2.0	0.55		1.9	B	1.0	U	1.8	U
4P403301	2.0–3.0	0.08		1.7	B	1.0	U	1.8	U
4P403302	2.0–3.0	0.12		1.8	B	1.0	U	1.8	U
4P403401	3.0–4.0	0.02	U	2.9	B	1.0	U	1.8	U
4P403501	4.0–5.0	0.06		1.6	B	1.0	U	1.8	U
4P403601	5.0–6.0	0.04		1.7	B	1.0	U	1.8	U
4P403701	6.0–7.0	0.07		1.5	B	1.2	B	1.8	U
4P403801	7.0–8.0	0.02	B	2.0	B	1.0	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D5.5 Sampling Zone 5

Four coreholes were drilled in Sampling Zone 5, ranging from 8 cm (3 in.) to 0.3 m (1 ft). Samples only were collected from the first interval due to low depth to basalt.

- Corehole 5-A
  - Depth—20 cm (8 in.)
  - Recovered only 20 cm (8 in.)
- Corehole 5-B
  - Depth—0.3 m (1 ft)
  - Full recovery occurred for the 0.3-m (1-ft) interval
- Corehole 5-C
  - Depth—0.3 m (1 ft)
  - Full recovery occurred for the 0.3-m (1-ft) interval
- Corehole 5-D
  - Depth—8 cm (3 in.)
  - No sample was recovered for the 8-cm (3-in.) interval.

The analytical results for Sample Zone 5 are presented in Table D-7. Samples were analyzed for radionuclides (including gamma-emitting isotopes, strontium-90, and uranium isotopes), total mercury, and TCLP metals (including chromium, mercury, and silver). As can be seen from the data, mercury concentrations that exceeded the final remediation goal of 8.4 mg/kg are found in the single interval sampled. None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24. Concentrations of uranium isotopes in the interval exceeded the naturally occurring background levels. Cesium-137 was found in this interval; however, its concentration is less than the 95% upper confidence level of 0.82 pCi/g found in soil surrounding the INEEL that is attributed to fallout from atmospheric nuclear testing. The concentration of Ra-226 was elevated in the duplicate sample above naturally occurring levels, but was below the minimum detectable activity in the sample. Strontium-90 was not detected in either the sample or its duplicate.

Table D-7. Sampling Zone 5 analytical results.

Sample ID:	4P404001		4P404002	
Interval (ft):	0–1.0		0–1.0	
Gamma spectrometry (pCi/g)				
Cs-137	3.88 +/- 0.50 E-01		3.60 +/- 0.40 E-01	
Ra-226	<1.64		4.93 +/- 0.61 E+00	
Sr-90 (pCi/g)	<0.326		<0.332	
Uranium isotope (pCi/g)				
U-234	4.11 +/- 0.33 E+00		4.49 +/- 0.35 E+00	
U-235	6.88 +/- 0.74 E-01		4.73 +/- 0.55 E-01	
U-238	5.53 +/- 0.43 E+00		6.35 +/- 0.48 E+00	
Mercury (mg/kg)	63.0		56.4	
TCLP metals (µg/L)				
Chromium	1.7	B	1.2	B
Mercury	11.9		6.9	
Silver	1.8	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D5.6 Sampling Zone 6

Four coreholes were drilled in Sampling Zone 6, ranging from 0.3 m (1 ft) to 1.8 m (6 ft). Samples were collected from the 0.3-m (1-ft) intervals down to the 1.8-m (6-ft) depth.

- Corehole 6-A-21
  - Depth—0.3 m (1 ft)
  - Full recovery occurred for the 0.3-m (1-ft) interval
- Corehole 6-B-22
  - Depth—1.8 m (6 ft)
  - Full recovery occurred at all depths
- Corehole 6-C-23
  - Depth—76 cm (2 ft 6 in.)

- Full recovery occurred for the first two intervals with 13 cm (5 in.) recovered from the 0.6- to 0.9-m (2- to 3-ft) interval

- Corehole 6-D-24
  - Depth—84 cm (2 ft 9 in.)
  - Full recovery of all intervals occurred down to 84 cm (2 ft 9 in.).

The analytical results for Sample Zone 6 are presented in Table D-8. Samples were analyzed for radionuclides (including gamma-emitting isotopes, strontium-90, and uranium isotopes), total mercury, and TCLP metals (including chromium, mercury, and silver). One sample collected from the 0- to 0.3-m (0- to 1-ft) interval was analyzed for methyl mercury. As can be seen from the data, mercury concentrations that exceeded the final remediation goal of 8.4 mg/kg were found in all six depth intervals from 0 to 1.8 m (0 to 6 ft). None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24. Concentrations of uranium isotopes in the first and third intervals (0 to 0.3 m [0 to 1 ft] and 0.6 to 0.9 m [2 to 3 ft], respectively) exceeded the naturally occurring background levels. Cesium-137 was found in the first depth interval from 0 to 0.3 m (0 to 1 ft); however, its concentration is less than the 95% upper confidence level of 0.82 pCi/g found in soil surrounding the INEEL that is attributed to fallout from atmospheric nuclear testing. The Ra-226 concentrations were elevated in five of the six intervals above naturally occurring levels, with the exception being the 0.6- to 0.9-m (2- to 3-ft) interval. Strontium-90 was not detected in samples collected from any of the six depth intervals. The methyl mercury concentration was below the laboratory method detection limit of 0.005 mg/kg.

D5.7 Sampling Zone 7

Four coreholes were drilled in Sampling Zone 7, ranging from 46 cm (1 ft 6 in.) to greater than 3.6 m (12 ft). Samples were collected from the 0.3-m (1-ft) intervals down to the 1.5-m (5-ft) depth.

- Corehole 7-A-25
  - Depth—46 cm (1 ft 6 in.)
  - Recovered 36 cm (14 in.) of sediment
- Corehole 7-B-27
  - Depth—1.1 m (3 ft 6 in.)
  - No sample was recovered for the 0.3- to 0.6-m (1- to 2-ft) interval and only 15 cm (6 in.) was recovered from the 0.9- to 1.1-m (3- to 3-ft 6-in.) interval
- Corehole 7-C-29
  - Depth—1.5 m (5 ft)
  - Full recovery occurred at all depths
- Corehole 7-D-31
  - Depth—>3.6 m (12 ft)
  - Full recovery occurred at all depths.

Table D-8. Sampling Zone 6 analytical results.

Sample ID:	4P4047		4P4048		4P4049		4P4050		4P4051		4P4052	
Interval (ft):	0–1.0		1.0–2.0		2.0–3.0		3.0–4.0		4.0–5.0		5.0–6.0	
Gamma spectrometry (pCi/g)												
Cs-137	2.45 +/- 0.41 E-01		<0.0985		<0.0812		<0.0967		<0.0660		<0.0724	
Ra-226	3.98 +/- 0.68 E+00		2.45 +/- 0.51 E+00		<1.70		2.99 +/- 0.68 E+00		2.20 +/- 0.50 E+00		1.90 +/- 0.45 E+00	
U-235	<0.409		<0.379		4.88 +/- 1.04 E-01		<0.490		<0.398		<0.239	
Sr-90 (pCi/g)	<0.361		<0.343		<0.384		<0.356		<0.353		<0.350	
Uranium isotope (pCi/g)												
U-234	2.20 +/- 0.19 E+00		1.16 +/- 0.11 E+00		9.72 +/- 0.74 E+00		1.09 +/- 0.10 E+00		1.25 +/- 0.12 E+00		1.03 +/- 0.10 E+00	
U-235	1.76 +/- 0.31 E-01		1.19 +/- 0.24 E-01		1.13 +/- 0.11 E+00		1.30 +/- 0.25 E-01		1.20 +/- 0.25 E-01		9.91 +/- 2.12 E-02	
U-238	3.16 +/- 0.26 E+00		1.41 +/- 0.13 E+00		1.38 +/- 0.10 E+01		1.35 +/- 0.12 E+00		1.33 +/- 0.12 E+00		1.11 +/- 0.10 E+00	
Mercury (mg/kg)	57.3		75.8		82.8		54.7		42.7		47.0	
TCLP metals (µg/L)												
Chromium	1.6	B	1.6	B	1.3	B	1.8	B	2.6	B	2.1	B
Mercury	1.3	B	32.4		7.6		78.2		75.4		56.0	
Silver	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
Methyl mercury (mg/kg) 0.005		U	NA		NA		NA		NA		NA	

TCLP = toxicity characteristic leaching procedure

The analytical results for Sample Zone 7 are presented in Table D-9. Samples were analyzed for radionuclides (including gamma-emitting isotopes, strontium-90, and uranium isotopes), total mercury, and TCLP metals (including chromium, mercury, and silver). Three samples collected from the 0- to 0.3-m (0- to 1-ft), 0.3- to 0.6-m (1- to 2-ft), and 0.9- to 1.2-m (3- to 4-ft) intervals also were analyzed for methyl mercury. As can be seen from the data, mercury concentrations that exceeded the final remediation goal of 8.4 mg/kg were found in all five depth intervals from 0 to 1.5 m (0 to 5 ft). None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24. Concentrations of uranium isotopes in the first three intervals from 0 to 0.9 m (0 to 3 ft) exceeded the naturally occurring background levels with the uranium isotopic concentration for the fourth interval from 0.9 to 1.2 m (3 to 4 ft) slightly elevated above the 95% upper confidence limit for soil at the INEEL. Cesium-137 was present in soil from the first two intervals (0 to 0.6 m [0 to 2 ft]); however, the concentrations were less than the 95% upper confidence level of 0.82 for soil surrounding the INEEL. The concentration of Ra-226 was elevated in the 0.9- to 1.5-m (3- to 5-ft) intervals above naturally occurring levels. Also, Nb-95 was detected in one sample collected from the 0.6- to 0.9-m (2- to 3-ft) interval; however, this result is questionable given that no Cs-137 was detected in this interval as would be expected in the presence of Nb-95, and Nb-95's half-life is only 35 days. Furthermore, the isotope was not detected in the field duplicate sample. No Sr-90 was detected at any of the intervals. The methyl mercury concentrations in the three samples collected were below the laboratory method detection limit of 0.005 mg/kg.

D5.8 Sampling Zone 8

Four coreholes were drilled in Sampling Zone 8, ranging from 0.6 m (2 ft) to 1.4 m (4 ft 6 in.). Samples were collected from the 0.3-m (1-ft) intervals down to the 1.4-m (4-ft 6-in.) depth.

- Corehole 8-C-30
  - Depth—1.1 m (3 ft 6 in.)
  - Full recovery occurred at all depths
- Corehole 8-B-28
  - Depth—1.2 m (4 ft)
  - Full recovery occurred at all depths
- Corehole 8-A-26
  - Depth—0.6 m (2 ft)
  - Full recovery occurred at all depths
- Corehole 8-D-32
  - Depth—1.4 m (4 ft 6 in.)
  - Full recovery occurred at all depths including 15 cm (6 in.) of the 1.2- to 1.4-m (4- to 4-ft 6-in.) interval.

Table D-9. Sampling Zone 7 analytical results.

Sample ID:	4P405301		4P405401		4P405501		4P405502		4P405601		4P405701	
Interval (ft):	0–1.0		1.0–2.0		2.0–3.0		2.0–3.0		3.0–4.0		4.0–5.0	
Gamma spectrometry (pCi/g)												
Cs-137	5.01 +/- 0.50 E-01		9.62 +/- 2.34 E-02		<0.0569		<0.0970		<0.0916		<0.0940	
Nb-95	<0.0475		0.0878		1.19 +/- 0.29 E-01		<0.101		<0.101		<0.133	
Ra-226	<1.31		<1.73		<1.33		<1.75		2.85 +/- 0.60 E+00		3.29 +/- 0.61 E+00	
U-235	<0.387		6.56 +/- 1.15 E-01		4.03 +/- 0.88 E-01		8.53 +/- 1.85 E-01		<0.404		<0.486	
Sr-90 (pCi/g)	<0.432		<0.370		<0.372		<0.307		<0.349		<0.332	
Uranium isotope (pCi/g)												
U-234	4.77 +/- 0.37 E+00		1.13 +/- 0.09 E+01		1.44 +/- 0.11 E+01		1.21 +/- 0.09 E+01		1.51 +/- 0.13 E+00		9.11 +/- 0.90 E-01	
U-235	4.39 +/- 0.52 E-01		1.21 +/- 0.12 E+00		1.34 +/- 0.13 E+00		1.10 +/- 0.11 E+00		1.48 +/- 0.27 E-01		9.14 +/- 2.07 E-02	
U-238	8.80 +/- 0.66 E+00		1.89 +/- 0.14 E+01		2.30 +/- 0.18 E+01		2.05 +/- 0.15 E+01		2.15 +/- 0.18 E+00		1.15 +/- 0.11 E+00	
Mercury (mg/kg)	85.3		45.5		68.4		67.7		118		44.2	
TCLP metals (µg/L)												
Chromium	1.9	B	2.3	B	2.6	B	3.1	B	1.2	B	1.0	B
Mercury	5.3		39.9		14.2		117.0		117.0		148.0	
Silver	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
Methyl mercury (mg/kg)	0.005	U	0.005	U	NA		NA		0.005U		NA	

TCLP = toxicity characteristic leaching procedure

The analytical results for Sample Zone 8 are presented in Table D-10. Samples were analyzed for radionuclides (including gamma-emitting isotopes, strontium-90, and uranium isotopes), total mercury, and TCLP metals (including chromium, mercury, and silver). Three samples collected from the 0- to 0.3-m (0- to 1-ft), 0.3- to 0.6-m (1- to 2-ft), and 0.6- to 0.9-m (2- to 3-ft) intervals also were analyzed for methyl mercury. As can be seen from the data, mercury concentrations that exceeded the final remediation goal of 8.4 mg/kg are found in all four depth intervals from 0 to 1.2 m (0 to 4 ft). None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24. Concentrations of uranium isotopes in the first three intervals from 0 to 0.9 m (0 to 3 ft) exceeded the naturally occurring background levels. Cesium-137 was found in the first depth interval from 0 to 0.3 m (0 to 1 ft); however, its concentration is less than the 95% upper confidence level of 0.82 pCi/g found in soil surrounding the INEEL that is attributed to fallout from atmospheric nuclear testing. The concentration of Ra-226 was elevated in the 0.6- to 0.9-m (2- to 3-ft) interval above naturally occurring levels. In addition, Sr-90 was detected in samples collected from both the 0.6- to 0.9-m (2- to 3-ft) and 0.9- to 1.2-m (3- to 4-ft) intervals. The methyl mercury concentrations in the three samples collected were below the laboratory method detection limit of 0.005 mg/kg.

Table D-10. Sampling Zone 8 analytical results.

Sample ID:	4P405901		4P406001		4P406101		4P406201	
Interval (ft):	0–1.0		1.0–2.0		2.0–3.0		3.0–4.0	
Gamma Spectrometry (pCi/g)								
Cs-137	1.01 +/- 0.24 E-01		<0.0883		<0.0584		<0.0924	
Ra-226	<11.9		<1.60		6.34 +/- 0.72 E+00		<1.71	
U-235	4.14 +/- 1.08 E-01		6.22 +/- 1.47 E-01		<0.257		<0.350	
Sr-90 (pCi/g)	<0.335		<0.337		4.53 +/- 0.73 E-01		3.63 +/- 0.75 E-01	
Uranium Isotope (pCi/g)								
U-234	9.22 +/- 0.60 E+00		4.88 +/- 0.31 E+00		8.79 +/- 0.56 E+00		1.09 +/- 0.07 E+01	
U-235	9.11 +/- 0.74 E-01		5.46 +/- 0.45 E-01		7.30 +/- 0.59 E-01		1.07 +/- 0.09 E+01	
U-238	1.68 +/- 0.11 E+01		8.88 +/- 0.56 E+00		1.54 +/- 0.10 E+01		2.19 +/- 0.14 E+01	
Mercury (mg/kg)	90.3		60.6		60.6		126	
TCLP Metals (µg/L)								
Chromium	1.7	B	2.8	B	7.1		1.1	B
Mercury	2.9		13.2		6.7		27.7	
Silver	1.8	U	1.8	U	1.8	U	1.8	U
Methyl Mercury (mg/kg)	0.005	U	0.005	U	0.005	U	NA	

TCLP = toxicity characteristic leaching procedure

D5.9 Sampling Zone 9

Four coreholes were drilled in Sampling Zone 9, ranging from 0.76 m (2 ft 6 in.) to 1.8 m (6 ft). Samples were collected from the 0.3-m (1-ft) intervals down to the 1.8-m (6-ft) depth. (Some recoveries were more than the depths that were cored, because dirt falls in from the sides as the samples are taken.)

- Corehole 9-B-35
  - Depth—0.76 m (2 ft 6 in.)
  - Full recovery occurred at all depths including 15 cm (6 in.) of the 0.6- to 0.76-m (2- to 2-ft 6-in.) interval
- Corehole 9-C-33
  - Depth—1.75 m (5 ft 9 in.)
  - Full recovery occurred at all depths including 25 cm (10 in.) at the 1.5- to 1.75-m (5- to 5-ft 9-in.) interval
- Corehole 9-A-37
  - Depth—1.65 m (5 ft 6 in.)
  - Full recovery occurred at all depths including a 20-cm (8-in.) recovery at the 1.5- to 1.65-m (5- to 5-ft 6-in.) interval
- Corehole 9-D-39
  - Depth—1.8 m (6 ft)
  - Full recovery occurred at all depths.

The analytical results for Sample Zone 9 are presented in Table D-11. Samples were analyzed for total mercury and TCLP metals, including chromium, mercury, and silver. As can be seen from the data, none of the mercury concentrations exceeded the final remediation goal of 8.4 mg/kg. In addition, none of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-11. Sampling Zone 9 analytical results.

Sample ID	Interval (ft)	Mercury (mg/kg)	TCLP Metals (µg/L)					
			Chromium		Mercury		Silver	
4P406501	0–1.0	4.5	1.8	B	1.0	U	1.8	U
4P406601	1.0–2.0	1.7	3.1	B	1.0	U	1.8	U
4P406701	2.0–3.0	0.21	2.1	B	1.0	U	1.8	U
4P406018	3.0–4.0	0.13	2.5	B	1.0	U	1.8	U
4P406901	4.0–5.0	0.09	2.3	B	1.0	U	1.8	U
4P407001	5.0–6.0	0.06	1.7	B	1.0	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D5.10 Sampling Zone 10

Four coreholes were drilled in Sampling Zone 10, ranging from 2.5 cm (1 in.) to 0.6 m (2 ft). Samples were collected from the 0.3-m (1-ft) intervals down to the 0.6-m (2-ft) depth.

- Corehole 10-A
  - Depth—2.5 cm (1 in.)
  - No recovery because at basalt
- Corehole 10-B
  - Depth—0.3 m (1 ft)
  - Recovered 25 cm (10 in.) from the 0.3-m (1-ft) interval
- Corehole 10-C
  - Depth—0.3 m (1 ft)
  - Recovered 15 cm (6 in.) from the 0.3-m (1-ft) interval
- Corehole 10-D
  - Depth—0.6 m (2 ft)
  - Full recovery occurred at all depths.

The analytical results for Sample Zone 10 are presented in Table D-12. Samples were analyzed for total mercury and TCLP metals, including chromium, mercury, and silver. As can be seen from the data, none of the mercury concentrations exceeded the final remediation goal of 8.4 mg/kg. In addition, none of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-12. Sampling Zone 10 analytical results.

Sample ID	Interval (ft)	Mercury (mg/kg)	TCLP Metals (µg/L)					
			Chromium		Mercury		Silver	
4P407201	0–1.0	4.5	1.6	B	1.0	U	1.8	U
4P407301	1.0-2.0	2.5	3.4	B	1.0	U	1.8	U
4P407302	1.0-2.0	0.97	2.7	B	1.0	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D5.11 Sampling Zone 11

Four coreholes were drilled in Sampling Zone 11, ranging from 15 cm (6 in.) to 1.8 m (6 ft). Samples only were collected from the 0.3-m (1-ft) intervals down to the 1.8-m (6-ft) depth.

- Corehole 11-A-41
  - Depth—15 cm (6 in.)
  - Recovered 15 cm (6 in.) using hand auger
- Corehole 11-B-42
  - Depth—0.6 m (2 ft)
  - No sample was recovered for the 0.3- to 0.6-m (1- to 2-ft) interval
- Corehole 11-C-43
  - Depth—1.8 m (6 ft)
  - Full recovery occurred at all depths
- Corehole 11-D-44
  - Depth—1.8 m (6 ft)
  - Full recovery occurred at all depths.

The analytical results for Sample Zone 11 are presented in Table D-13. Samples were analyzed for total mercury and TCLP metals, including chromium, mercury, and silver. As can be seen from the data, mercury concentrations that exceeded the final remediation goal of 8.4 mg/kg are present in the second and third intervals from 0.3 to 0.9 m (1 to 3 ft). None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-13. Sampling Zone 11 analytical results.

Sample ID	Interval (ft)	Mercury (mg/kg)	TCLP Metals (µg/L)					
			Chromium		Mercury		Silver	
4P408001	0–1.0	5.2	1.5	B	1.0	U	1.8	U
4P408101	1.0–2.0	15.0	0.80	U	1.0	U	1.8	U
4P408201	2.0–3.0	19.2	0.80	U	1.0	U	1.8	U
4P408301	3.0–4.0	2.2	0.80	U	1.0	U	1.8	U
4P408401	4.0–5.0	1.0	0.80	U	1.0	U	1.8	U
4P408501	5.0–6.0	2.2	0.80	U	1.0	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D5.12 Sampling Zone 12

Four coreholes were drilled in Sampling Zone 12, ranging from 1.8 m (6 ft) to greater than 2.7 m (9 ft). One of the four coreholes was drilled to a depth greater than 2.7 m (9 ft); however, samples only were collected from the 0.3-m (1-ft) intervals down to the 2.7-m (9-ft) depth.

- Corehole 12-A-25
  - Depth—1.8 m (6 ft)
  - Full recovery occurred at all depths
- Corehole 12-B-47
  - Depth—> 2.7 m (9 ft)
  - Full recovery occurred up to 2.7 m (9 ft)
- Corehole 12-C-51
  - Depth—1.9 m (6 ft 3 in.)
  - Full recovery occurred at all depths
- Corehole 12-D-53
  - Depth—2.3 m (7 ft 7 in.)
  - Full recovery occurred at all depths

The analytical results for Sample Zone 12 are presented in Table D-14. Samples were analyzed for total mercury and TCLP metals, including chromium, mercury, and silver. As can be seen from the data, mercury concentrations that exceeded the final remediation goal of 8.4 mg/kg are present in the first two intervals down to 0.6 m (2 ft). None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-14. Sampling Zone 12 analytical results.

Sample ID	Interval (ft)	Mercury (mg/kg)	TCLP Metals (µg/L)					
			Chromium		Mercury		Silver	
4P408601	0–1.0	9.2	1.1	B	1.0	U	1.8	U
4P408701	1.0–2.0	13.3	2.0	B	1.0	U	1.8	U
4P408801	2.0–3.0	2.2	1.8	B	1.2	B	1.8	U
4P408901	3.0–4.0	1.9	1.3	B	1.3	B	1.8	U
4P409001	4.0–5.0	1.3	0.80	U	1.0	U	1.8	U
4P409101	5.0–6.0	1.9	1.6	B	1.0	U	1.8	U
4P409201	6.0–7.0	2.5	2.5	B	2.5		1.8	U
4P409301	7.0–8.0	1.1	1.7	B	1.0	U	1.8	U
4P409401	8.0–9.0	1.7	2.6	B	3.7		1.8	U

TCLP = toxicity characteristic leaching procedure

D5.13 Sampling Zone 13

Four coreholes were drilled in Sampling Zone 13, ranging from 0.76 m (2 ft 6 in.) to greater than 2.4 m (8 ft). One of the four coreholes was drilled to a depth greater than 2.4 m (8 ft); however, samples only were collected from the 0.3-m (1-ft) intervals down to the 2.4-m (8-ft) depth.

- Corehole 13-A-46
  - Depth—1.2 m (4 ft)
  - Full recovery occurred at all depths
- Corehole 13-B-48
  - Depth—0.9 m (3 ft)
  - Full recovery occurred at all depths
- Corehole 13-C-54
  - Depth—0.76 m (2 ft 6 in.)
  - Full recovery occurred at all depths
- Corehole 13-D-52
  - Depth—>2.4 m (8 ft)
  - Full recovery occurred at all depths down to 2.4 m (8 ft).

The analytical results for Sample Zone 13 are presented in Table D-15. Samples were analyzed for total mercury and TCLP metals, including chromium, mercury, and silver. As can be seen from the data, mercury concentrations that exceeded the final remediation goal of 8.4 mg/kg are present in the first three intervals down to 0.9 m (3 ft). None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-15. Sampling Zone 13 analytical results.

Sample ID	Interval (ft)	Mercury (mg/kg)	TCLP Metals (µg/L)					
			Chromium		Mercury		Silver	
4P409501	0–1.0	22.4	1.5	B	1.0	U	1.8	U
4P409502	0–1.0	34.4	1.2	B	1.0	U	1.8	U
4P409601	1.0–2.0	10.4	1.2	B	1.0	U	1.8	U
4P409701	2.0–3.0	2.0	1.3	B	1.0	U	1.8	U
4P409801	3.0–4.0	0.76	1.1	B	1.0	U	1.8	U
4P409901	4.0–5.0	0.08	2.6	B	1.0	U	1.8	U
4P410001	5.0–6.0	0.07	1.6	B	1.0	U	1.8	U
4P410101	6.0–7.0	0.04	3.3	B	1.0	U	1.8	U
4P410201	7.0–8.0	0.05	3.0	B	1.0	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D5.14Sampling Zone 14

Four coreholes were drilled in Sampling Zone 14, ranging from 1.1 m (3 ft 6 in.) to greater than 2.4 m (8 ft). One of the four coreholes was drilled to a depth greater than 2.4 m (8 ft); however, samples only were collected from the 0.3-m (1-ft) intervals down to the 2.4-m (8-ft) depth.

- Corehole 14-A-50
  - Depth—2.0 m (6 ft 6 in.)
  - Full recovery occurred at all depths
- Corehole 14-B-55
  - Depth—1.1 m (3 ft 6 in.)
  - Full recovery occurred at all depths down to 0.9 m (3 ft)—no recovery for the 0.9- to 1.1-m (3- to 3-ft 6-in.) interval
- Corehole 14-C-56
  - Depth—1.85 m (6 ft 1 in.)
  - Full recovery occurred at all depths down to 1.8 m (6 ft)
- Corehole 14-D-49
  - Depth—>2.4 m (8 ft)
  - Full recovery occurred at all depths down to 2.4 m (8 ft).

The analytical results for Sample Zone 14 are presented in Table D-16. Samples were analyzed for total mercury and TCLP metals, including chromium, mercury, and silver. As can be seen from the data, mercury concentrations that exceeded the final remediation goal of 8.4 mg/kg are present in the first two intervals down to 0.6 m (2 ft) and then again at the 1.2- to 1.5-m (4- to 5-ft) interval. None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-16. Sampling Zone 14 analytical results.

Sample ID	Interval (ft)	Mercury (mg/kg)	TCLP Metals (µg/L)					
			Chromium		Mercury		Silver	
4P410301	0–1.0	41.4	1.4	B	7.1		1.8	U
4P410401	1.0–2.0	40.0	0.9	B	3.3		1.8	U
4P410501	2.0–3.0	5.1	1.1	B	1.0	U	1.8	U
4P410601	3.0–4.0	2.7	0.8	U	1.2	B	1.8	U
4P410701	4.0–5.0	12.1	2.7	B	14.9		1.8	U
4P410801	5.0–6.0	1.3	3.7	B	4.0		1.8	U
4P410901	6.0–7.0	2.2	4.6	B	1.6	B	1.8	U
4P411001	7.0–8.0	0.03	2.8	B	3.3		1.8	U

TCLP = toxicity characteristic leaching procedure

D5.15Sampling Zone 15

Four coreholes were drilled in Sampling Zone 15, ranging from 1.5 m (5 ft) to 2.0 m (6 ft 6 in.). Samples were collected from the 0.3-m (1.0-ft) intervals down to the 2.0-m (6-ft 6-in.) depth.

- Corehole 15-A
  - Depth—1.5 m (5 ft)
  - Full recovery occurred at all depths
- Corehole 15-B
  - Depth—2.0 m (6 ft 6 in.)
  - Full recovery occurred at all depths
- Corehole 15-C
  - Depth—2.0 m (6 ft 6 in.)
  - Full recovery occurred at all depths
- Corehole 15-D
  - Depth—1.7 m (5 ft 6 in.)
  - Full recovery occurred at all depths.

The analytical results for Sample Zone 15 are presented in Table D-17. Samples were analyzed for total mercury and TCLP metals, including chromium, mercury, and silver. As can be seen from the data, none of the mercury concentrations exceeded the final remediation goal of 8.4 mg/kg. In addition, none of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-17. Sampling Zone 15 analytical results.

Sample ID	Interval (ft)	Mercury (mg/kg)	TCLP Metals (µg/L)					
			Chromium		Mercury		Silver	
4P412001	0–1.0	0.18	0.80	U	1.0	U	1.8	U
4P412101	1.0–2.0	0.09	1.9	B	1.0	U	1.8	U
4P412201	2.0–3.0	0.07	1.2	B	1.0	U	1.8	U
4P412301	3.0–4.0	0.29	1.9	B	1.0	U	1.8	U
4P412401	4.0–5.0	1.8	2.5	B	1.0	U	1.8	U
4P412501	5.0–6.0	0.05	1.4	B	1.0	U	1.8	U
4P412601	6.0–7.0	0.05	2.0	B	1.0	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D5.16Miscellaneous Sampling

A total of four core samples were collected from the basalt, including two from within Sampling Zone 6 and two from within Zone 7. These samples were analyzed for total mercury. The results are summarized in Table D-18. Mercury concentrations in one of the four basalt samples exceeded the final remediation goal of 8.4 mg/kg. These samples were re-analyzed after brushing off any residual soil on the basalt. The mercury concentrations were all lower than the final remediation goal in this re-analysis.

Table D-18. Basalt core analytical results.

Sample ID	Core	Recovery	Interval (ft):	Mercury Concentration (mg/kg)	Re-analyzed Mercury Concentration (mg/kg)
4P411301	6-1	10 cm (4 in.)	6.0–6.25	119	5.4
4P411401	6-2	20 cm (8 in.)	6.0–6.25	3.4	2.9
4P411501	7-1	23 cm (9 in.)	6.0–6.25	0.3	0.3
4P411601	7-1	18 cm (7 in.)	6.0–6.25	6.5	2.4

In addition, samples were collected (Table D-19) from a large and a small soil pile (Sample Numbers 4P411701 and 4P411801, respectively), sediment lying between Zones 2 and 6 (4P413201), the surface of the inlet trench (4P413301), and surface soil immediately northeast of Zone 13 (4P413401). These samples were analyzed for total mercury and TCLP metals, including chromium, mercury, and silver. The mercury concentrations for the samples collected from the large soil pile, the sediment lying between Zones 2 and 6, the surface of the inlet trench, and the surface soils immediately northeast of Zone 13 exceeded the final remediation goal of 8.4 mg/kg. None of the three metals analyzed by TCLP exceeded the maximum concentrations for the toxicity characteristic, as provided in 40 CFR 261.24.

Table D-19. Analytical results for miscellaneous samples.

Sample ID:	Mercury (mg/kg)	TCLP Metals (µg/L)					
		Chromium		Mercury		Silver	
4P4117	16.2	1.2	B	1.0	U	1.8	U
4P4118	0.62	0.80	U	1.1	B	1.8	U
4P4132	90.5	0.80	U	11.0		1.8	U
4P4133	78.5	1.1	B	1.0	U	1.8	U
4P4134	43.5	1.4	B	1.0	U	1.8	U

TCLP = toxicity characteristic leaching procedure

D6. MERCURY SUMMARY

Table D-20 summarizes the mercury concentrations by interval within zone. This provides a description of the vertical and horizontal extent of contamination across the CFA-04 site. Mercury concentrations generally are lower than were obtained during previous sampling (DOE-ID 2002a). Previous sampling was done in 6-in. intervals, whereas this sampling was done in 12-in. intervals that were then composited for a zone. In accordance with the preremediation sampling plan, the data in Table D-20 are to be used to determine where excavation will occur. Although the concentrations generally are lower, the same areas that would have been excavated in accordance with previous sampling are to be excavated in accordance with this sampling. The difference is that this sampling indicates that the waste stream as a whole has a lower mercury concentration. Although TCLP mercury was not found during this sampling, the area within Zones 6 and 7 where previous TCLP mercury was found should be treated as though it exceeds TCLP mercury for waste disposition purposes. It also should be noted for waste disposition purposes that TCLP chromium and silver were not exceeded.

Table D-20. Summary of mercury concentrations in mg/kg.

	Sampling Interval (ft)								
Zone	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9
1	1.9	0.14	0.05	0.08	0.06	0.11	—	—	—
2	8.8/2.5	2.4	0.90	0.84	0.24	—	—	—	—
3	2.9	2.7	0.21	0.08	0.05	0.04	0.05	0.06	—
4	2.1	0.55	0.08/0.12	0.02	0.06	0.04	0.07	0.02	—
5	63.0/56.4	—	—	—	—	—	—	—	—
6	57.3	75.8	82.8	54.7	42.7	47.0	—	—	—
7	85.3	45.5	68.4/67.7	118	44.2	—	—	—	—
8	90.3	60.6	60.6	126	—	—	—	—	—
9	4.5	1.7	0.21	0.13	0.09	0.06	—	—	—
10	4.5	2.5/0.97	—	—	—	—	—	—	—
11	5.2	15.0	19.2	2.2	1.0	2.2	—	—	—
12	9.2	13.3	2.2	1.9	1.3	1.9	2.5	1.1	1.7
13	22.4/34.4	10.4	2.0	0.76	0.08	0.07	0.04	0.05	—
14	41.4	40.0	5.1	2.7	12.1	1.3	2.2	0.03	—
15	0.18	0.09	0.07	0.29	1.8	0.05	0.05	—	—

Note: For those intervals within a zone where two mercury concentrations are provided, one value is for the sample and the other is for a field duplicate.

Table D-21 summarizes the methyl mercury concentrations and compares the results to the total mercury concentrations for the same location.

Table D-21. Summary and comparison of methyl mercury and mercury concentrations.

Zone	Sampling Interval (ft)	Reported Methyl Mercury Concentration (mg/kg) (0.005 is the detection limit.)	Adjusted Percent Methyl Mercury Concentration (Reported concentration is scaled up for low matrix spike recovery.)	Mercury (mg/kg)	Percent Methyl Mercury (compared to the detection limit, if below)	Percent Methyl Mercury (compared to reported concentration)	Percent Methyl Mercury (compared to adjusted concentration)
1	0–1	0.00032 (U)	0.00055	1.9	0.3	0.02	0.03
2	0–1	0.00139 (U)	0.00238	8.8	0.06	0.02	0.03
2	0–1 (Duplicate)	0.00240 (U)	0.00410	2.5	0.2	0.1	0.2
6	0–1	0.00139 (U)	0.00238	57.3	0.009	0.002	0.004
7	0–1	0.00655 (J)	0.01120	85.3	0.008	0.008	0.01
7	1–2	0.00135 (U)	0.00231	45.5	0.01	0.003	0.005
7	3–4	0.00246 (U)	0.00421	118	0.004	0.002	0.004
8	0–1	0.00098 (U)	0.00168	90.3	0.006	0.001	0.002
8	1–2	0.00353 (U)	0.00603	60.6	0.008	0.006	0.01
8	2–3	0.00137 (U)	0.00234	60.6	0.008	0.002	0.004

Methyl mercury was only detected in one of the samples. This concentration is 0.008 % of the total mercury detected. This result validates the assumption used in the *Re-evaluation of the Final Remediation Goals for Mercury at the CFA-04 (CFA-674 Pond)* (INEEL 2002) by being below the conservative percentage of 0.5% methyl mercury and demonstrates that the 8.4-mg/kg final remediation goal is acceptable.

The analytical technique used for these analyses was determined to be acceptable despite being outside the 28-day hold time (31 to 40 days) and having a slightly low matrix spike recovery (55.2% and 61.6% with an average recovery of 58.5%). The hold time was exceeded because of the extra work that had to be done to modify the method. The samples were kept at 4°C, which should have prevented any loss of mercury. The low matrix spike recoveries are not surprising since the matrix is soil. The percent recoveries obtained for the aqueous laboratory continuing calibration verification samples were good (with 80–120%). The laboratory control samples that were run on a solid matrix also had good recoveries (86.3% and 100%). The high recoveries on the solid matrix control samples demonstrate the proficiency of the complete analytical system utilized. This includes the chemist, the preparatory technique, and the determinative EPA Method 1630.

Even with an adjustment for the low matrix spike recovery, the adjusted reported concentrations range from 0.004% to 0.2% (see Table D-21), which is still below the conservative percentage of 0.5% methyl mercury assumed in the development of the 8.4-mg/kg final remediation goal. In Table D-21, the calculated percentages based on the method detection limit range from 0.004% to 0.3% and the calculated percentages based on the reported concentrations range from 0.001% to 0.1%. It is not valid to use the reported concentrations since they are below the method detection limit and are not accurate. These percentages merely indicate how low the actual percentage of methyl mercury in the soil might be. It also is not valid to use the method detection limit since it overestimates how much methyl mercury is in the sample.

D7. REFERENCES

40 CFR 261.24, 2003, "Toxicity Characteristic," *Code of Federal Regulations,* Office of the Federal Register, January 2003.

40 CFR 268.40, 2003, "Applicability of Treatment Standards," *Code of Federal Regulations*, Office of the Federal Register, January 2003.

Blackmore, C., R. Peatross, and I. Stepan, 1996, *Preliminary Scoping Track 2 Summary Report for Operable Unit 4-05,* INEL-95/0626, Revision 0, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, April 1996.

Bloom, Nicolas S., John A. Colman, and Lee Barber, 1997, "Artifact Formation of Methyl Mercury during Aqueous Distillation and Alternative Techniques for the Extraction of Methyl Mercury from Environmental Samples," *Fresenius J. Anal. Chem.*, 358, pp. 371–377, February 1997.

DOE-ID, 1991, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory,* U.S. Department of Energy Idaho Operations Office, Idaho Department of Health and Welfare, and U.S. Environmental Protection Agency, December 1991.

DOE-ID, 1992, *Record of Decision—Central Facilities Area Motor Pool Pond, Operable Unit 4-11, Waste Area Group 4,* 5242, Revision 0, U.S. Department of Energy Idaho Operations Office, January 1992.

DOE-ID, 2000a, *Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10680, Revision 1, U.S. Department of Energy Idaho Operations Office, July 2000.

DOE-ID, 2000b, *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13*, DOE/ID-10719, Revision 2, U.S. Department of Energy Idaho Operations Office, July 2000.

DOE-ID, 2002a, *Field Sampling Plan for the Pre-Remediation Sampling of the Central Facilities Area-04 Pond*, DOE/ID-10994, Revision 2, U.S. Department of Energy Idaho Operations Office, September 2002.

DOE-ID, 2002b, *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites,* DOE/ID-10587, Revision 7, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, September 2002.

DOE-ID, 2003, *Explanation of Significant Differences to the Record of Decision for the Central Facilities Area, Operable Unit 4-13,* DOE/ID-11030, Revision 0, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, February 2003.

INEEL, 2002, *Re-evaluation of the Final Remediation Goals for Mercury at the CFA-04 (CFA-674 Pond)*, INEEL/EXT-02-00747, Revision 0, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, October 2002.

TPR-6559, 2002, "Sampling with a Hollow-Stem Auger," Revision 1, *Environmental Monitoring/Compliance Monitoring Handbook*, June 2002.

Attachment 1

Operating Procedure that the Laboratory used for the Methyl Mercury Analysis (Lot Numbers and Solution Numbers were used for In-Laboratory Tracking Purposes)

Attachment 1

Operating Procedure that the Laboratory used for the Methyl Mercury Analysis (Lot Numbers and Solution Numbers were used for In-Laboratory Tracking Purposes)

Extraction

1 Add 0.5 G of sediment sample to 35 ml teflon centrifuge tube.

2 Add spk to LCSW and MS, MSD. Spk w/ 300 ul of 50 ppb CH3Hg Inorg. # 3385

3 Add 5 ml of solution containing 18% KBr Lot# 3582 and 5% H2SO4 Lot #2561.

4 Add 1 ml of 1 mol/L CuSO4 solution. Lot # 2215

5 Leach by shaking for 1 hour.

6 Add 10 ml of CH2Cl2. Place on shaker at high speed for 1 hour.

7 Centrifuge for 30 min. @ 2000 RPM, to separate aquous and organic layer.

8 Pipette out 2 ml of CH2Cl2 into a 60 ml Teflon purge vessel and add 45 ml of reagent water.

9 Cap with a purge cap and set in water bath for 30 min. at 45 C. with N2 flow at 20 cm/min.

10 Sample is ready for ethylation. Ethylate in the same 60 ml Teflon tube.

Ethylation

1 Using the same 60 ml Teflon purge vessel containing the 45 ml of sample.
2 Add 400 ul of 2 M acetate buffer #TMRL 02-002-06
3 Add 0.04 mL of 1% NaBEt4 #TMRL ~~02-002-07~~ 02-004-01 5V 3/29/02
4 Cap reaction valve with caps with purging tubing inserted in cap. and swirl gentle to mix.
5 Allow to stand for 17 min.

Purging

6 Attach tube to purging setup. One end of tube to N2 flow one end to CarboTrap.
Allow to purge for 17 min.

Drying

7 Attach the CarboTrap (marked side) to the drying setup.
Allow to dry for 7 min.

Desorption of Methyl Mercury

7 Attach CarbTrap (marked side) to Chromatograph and Ar flow to other side.
8 Hit F5 on spectrophotometer keyboard.

DATE: 5-29-02 SIGNATURE: BJ

Appendix E

Waste Management Plan

Appendix E

Waste Management Plan

E1. PURPOSE/INTRODUCTION

The purpose of this waste management plan is to establish requirements for the management and disposal of waste generated during excavation, treatment, and disposal activities of mercury-contaminated soil, roofing materials, and miscellaneous construction debris from the Central Facilities Area (CFA) -04 pond. These work activities will be performed under Waste Area Group (WAG) 4, Operable Unit (OU) 4-13 at the Idaho National Engineering and Environmental Laboratory (INEEL). The scope of this plan covers industrial, low-level radioactive, hazardous, and mixed low-level waste generated as a result of WAG 4 remediation activities. This plan allows for dispositioning of waste at approved on-Site treatment and disposal facilities or off-Site treatment and disposal facilities, as deemed necessary. The plan also provides reference to the applicable waste management requirements that are contained in U.S. Department of Energy Idaho Operations Office (DOE-ID) documents. The overall scope of the WAG 4 remediation activities is presented in the main body of this report—*Waste Area Group 4 Remedial Design/Remedial Action Work Plan, CFA-04 Pond Mercury-Contaminated Soils, Operable Unit 4-13* (DOE-ID 2003).

Activities that could likely generate waste include, but are not limited to, the following:

- Excavating and stockpiling mercury-contaminated soil
- Removing asbestos-containing roofing materials and construction debris (including concrete, rebar, and gravel)
- Removing fencing, power poles, and power lines
- Performing field screening and sampling
- Performing on-Site stabilization of soil and/or macroencapsulation of debris, as necessary
- Decontaminating equipment and materials
- Packaging, transportation, and disposal activities
- Performing reclamation of the terrain (including backfilling, contouring, and revegetation).

E2. PROJECT-SPECIFIC WASTE CHARACTERISTICS

Several distinct waste types could be generated during this project as a result of remediation activities, including the following:

- Soil, gravel, and rock
- Asphalt and asbestos roofing materials
- Reinforced concrete

- Construction and demolition debris
- Personal protective equipment (PPE)
- Plastic sheeting, sampling debris, etc.
- Hydraulic oil spills
- Liquid decontamination residue
- Solid decontamination residue.

Some of this waste might be clean, but much of it could be contaminated. Subsequent to generation, any or all of the waste may be reclassified. Resource Conservation and Recovery Act (RCRA)-regulated constituents previously encountered in soil and debris samples collected from the site include arsenic, barium, cadmium, chromium, lead, mercury, nickel, and silver. Polychlorinated biphenyls have been detected in soil samples; however, polychlorinated biphenyl concentrations were well below the Toxic Substances Control Act regulated levels. Trace radionuclides including Cs-137, Sr-90, U-234, U-235, and U-238 also have been detected above background concentrations for the INEEL. In addition, asbestos-containing roofing materials have been identified in the pond area. These materials have been classified as non-friable.

E3. WASTE IDENTIFICATION

Based on a review of work activities and previously collected analytical data, the following potential waste types are identified:

- **Industrial waste:** Solid waste generated by industrial processes, manufacturing, and support processes (40 CFR 243, "Guidelines for the Storage and Collection of Residential, Commercial, and Industrial Solid Waste"). At the INEEL, industrial waste to be disposed of at the INEEL Landfill Complex does not include hazardous waste, radioactive waste, or land disposal restricted waste regulated under Subtitle C of RCRA (DOE-ID 2002).
- **Low-level radioactive waste:** Waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, by-product material—as defined in Section 11e (2) of the Atomic Energy Act of 1954, as amended—or naturally occurring radioactive material (DOE Order 435.1, "Radioactive Waste Management").
- **Hazardous waste:** Solid waste designated as hazardous by the U.S. Environmental Protection Agency RCRA regulations (40 CFR 261.3, "Definition of Hazardous Waste").
- **Mixed waste:** Waste containing both radioactive components (as defined by the Atomic Energy Act of 1954, as amended) and hazardous components (as defined by 40 CFR 261.3).

Waste that might be generated during remediation activities is summarized in Table E-1. This table describes the waste types, provides the anticipated disposition pathway, and references the waste acceptance criteria or guidance for management.

Table E-1. Possible waste generation and disposition.

Waste Description	Waste Type	Disposition Pathway[a]	Appropriate Waste Acceptance Criteria/Guidance
Administrative waste (paper products, office waste)	Industrial	INEEL Landfill Complex	INEEL Waste Acceptance Criteria (DOE-ID 2002)
Uncontaminated soil (i.e., not low-level or RCRA hazardous)	Industrial	INEEL Landfill Complex	INEEL Waste Acceptance Criteria (DOE-ID 2002)
Contaminated soil	Low-level, hazardous, or mixed	ICDF landfill	ICDF landfill waste acceptance criteria
Uncontaminated building and construction debris and asbestos-containing roofing material	Industrial	INEEL Landfill Complex	INEEL Waste Acceptance Criteria (DOE-ID 2002)
Contaminated building and construction debris	Low-level, hazardous, or mixed	ICDF landfill	ICDF landfill waste acceptance criteria
Uncontaminated monitoring waste (radiological swipes, masslins, etc.)	Industrial	INEEL Landfill Complex	INEEL Waste Acceptance Criteria (DOE-ID 2002)
Contaminated monitoring waste (radiological swipes, masslins, etc.)	Low-level, hazardous, or mixed	ICDF landfill	ICDF landfill waste acceptance criteria
Uncontaminated PPE (gloves, boots, shoe covers, coveralls, etc.)	Industrial	INEEL Landfill Complex	INEEL Waste Acceptance Criteria (DOE-ID 2002)
Contaminated PPE (gloves, boots, shoe covers, coveralls, etc.)	Low-level, hazardous, or mixed	ICDF landfill	ICDF landfill waste acceptance criteria
Uncontaminated sampling waste (wipes, spoons, etc.)	Industrial	INEEL Landfill Complex	INEEL Waste Acceptance Criteria (DOE-ID 2002)
Contaminated sampling waste (wipes, spoons, etc.)	Low-level, hazardous, or mixed	ICDF landfill	ICDF landfill waste acceptance criteria
Liquid and solid decontamination residues	Industrial, low-level, hazardous, or mixed	INEEL Landfill Complex or ICDF landfill	INEEL Waste Acceptance Criteria (DOE-ID 2002) or ICDF landfill waste acceptance criteria
Petroleum-contaminated media (i.e., soil, plastic sheeting, and PPE from hydraulic fluid spills)	Industrial	INEEL Landfill Complex	INEEL Waste Acceptance Criteria (DOE-ID 2002)
Contaminated equipment that cannot be decontaminated	Low-level, hazardous, or mixed	ICDF landfill	ICDF landfill waste acceptance criteria
Maintenance-related waste (from vehicles, equipment, facilities, etc.)	Industrial	INEEL Landfill Complex	INEEL Waste Acceptance Criteria (DOE-ID 2002)

Table E-1. (continued).

Waste Description	Waste Type	Disposition Pathway[a]	Appropriate Waste Acceptance Criteria/Guidance
Spent or unusable (e.g., expired) chemicals and reagents	Industrial, low-level, hazardous, or mixed	INEEL Landfill Complex or ICDF landfill	INEEL Waste Acceptance Criteria (DOE-ID 2002) or ICDF landfill waste acceptance criteria
Miscellaneous waste (tools, debris, equipment, metal/plastic pipe, plastic sheeting, etc.)	Industrial, low-level, hazardous, or mixed	INEEL Landfill Complex or ICDF landfill	INEEL Waste Acceptance Criteria (DOE-ID 2002) or ICDF landfill waste acceptance criteria

a. The ultimate disposition path is contingent upon meeting the appropriate facility's waste acceptance criteria. If the waste does not meet the waste acceptance criteria, and alternative on-Site treatment and disposal locations are not available, then off-Site waste management options will be pursued.
DOE-ID = U.S. Department of Energy Idaho Operations Office
ICDF = INEEL CERCLA Disposal Facility
INEEL = Idaho National Engineering and Environmental Laboratory
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act

E4. WASTE DESIGNATION AND MANAGEMENT

All generated waste will be characterized as required by RCRA regulations (40 CFR 262.11, "Hazardous Waste Determination"). Hazardous waste determinations will be prepared for each waste stream in accordance with the requirements specified in Management Control Procedure (MCP) -62, "Waste Generator Services—Low-Level Waste Management"; MCP-63, "Waste Generator Services—Conditional Industrial Waste Management"; and MCP-70, "Waste Generator Services—Mixed Low-Level Waste Management."

Waste generated from the CFA-04 pond will be designated and characterized using process knowledge, historical analytical data, and/or analytical data generated during the course of remediation activities. Completed hazardous waste determinations will be maintained for all waste streams as part of the project file held by Waste Generator Services (WGS). Potential waste streams that might be generated during remediation activities include the following:

- Industrial solid waste, including asbestos-containing roofing material, to be disposed of at the INEEL Landfill Complex
- Low-level radioactive solid waste, including asbestos-containing building material, to be disposed of at the INEEL CERCLA Disposal Facility (ICDF)
- Low-level radioactive liquid waste to be solidified and disposed of at the ICDF
- Mixed low-level radioactive solid waste (i.e., soil) to be stabilized and disposed of at the ICDF
- Mixed low level radioactive solid waste (i.e., RCRA-regulated debris) to be macroencapsulated and disposed of at the ICDF.

Once the hazardous waste determinations are completed, the appropriate information will be entered into the INEEL Integrated Waste Tracking System (IWTS). All waste must meet the applicable waste acceptance criteria for the intended treatment/disposal facility prior to disposal.

E4.1 Industrial Waste

Solid waste and debris that are not contaminated (not a RCRA characteristic, listed, or mixed waste) and have been radiologically released are industrial waste. This waste may be disposed of at the INEEL Landfill Complex, subject to meeting that facility's waste acceptance criteria. Industrial waste generated during remediation activities will be transported to the INEEL Landfill Complex, which is located at CFA, for disposal. The waste must meet the waste acceptance criteria, which are described in the *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria* report (DOE-ID 2002), prior to disposal at the landfill. The INEEL Waste Acceptance Criteria report (DOE-ID 2002) requires some industrial waste to be segregated and managed as conditional industrial waste. Conditional industrial waste includes oil or fuel filters, petroleum-contaminated material from spills, asbestos-containing materials, or uncontaminated PPE.

E4.2 Low-level Radioactive, Hazardous, and Mixed Waste

Contaminated (low-level radioactive, hazardous, and mixed) solid waste (non-aqueous) that meets the ICDF waste acceptance criteria will be treated and disposed of at the ICDF. Contaminated aqueous waste that meets the ICDF waste acceptance criteria will be solidified and disposed of at the ICDF. Aqueous and non-aqueous waste not meeting the disposal requirements of the ICDF will be containerized, treated, and/or stored (as necessary) until appropriate treatment/disposal criteria are met. Asbestos-containing waste that does not meet the INEEL Landfill Complex waste acceptance criteria will be disposed of at the ICDF. If management/disposal at INEEL facilities is not possible, then waste may be sent to an approved off-Site facility for treatment/disposal, subject to meeting the applicable waste acceptance criteria and off-Site criteria.

E4.3 Waste Storage

While waste is being actively generated by CFA-04 pond remedial operations, the waste will be temporarily managed and stored within the designated work area in containers appropriate for the type of waste being generated (e.g., hazardous or mixed waste liquids require secondary containment). Unless being actively filled, the containers shall remain closed at all times. The volume of waste stored at the site shall be kept to a minimum.

Whenever possible, the waste containers will be removed from the active work area directly to the ICDF or the CFA Landfill Complex, as appropriate. If temporary storage is required, a staging area will be established within the area of concern. Waste stored there will be labeled and roped off in compliance with applicable company and regulatory requirements. If the waste is stored at the treatment/disposal facility, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) waste will be managed in accordance with that facility's waste management plan.

If direct transfer of smaller waste containers (i.e., drums or boxes) to the treatment/disposal facility is not feasible, containers may be stored temporarily in an established CERCLA storage area located in the CFA-637 building. This could be necessary pending container profile approvals and facility acceptance. If temporary storage is required due to space limitations, the CERCLA storage area may be expanded or a new CERCLA storage area may be established to accommodate the waste.

The CERCLA storage area is located at CFA and managed in accordance with the substantive requirements of RCRA, as applicable, for temporary storage of waste (40 CFR 264, Subpart I, "Use and Management of Containers"). For example, if CERCLA waste with RCRA waste codes is stored in a CERCLA storage area, then the following items are located, tested, and maintained, unless hazards associated with the waste streams would not require the item:

1. Current copy of the registration posted at the CERCLA storage area
2. Communications, spill control, and safety equipment, as identified in the *Health and Safety Plan for the CFA-04 Mercury Pond Sampling and Remedial Action* (INEEL 2002)
3. "NO SMOKING" signs at or near a CERCLA storage area that stores ignitable or reactive waste.

Additional requirements include appropriate management of containers at the CERCLA storage area that includes the following:

1. Maintain the containers in good condition
2. Do not store waste that is incompatible with containers or container liners or place the waste in a container that previously held an incompatible waste or material
3. Keep all containers closed except when adding, removing, sampling, or measuring waste
4. Do not mix incompatible waste
5. Maintain sufficient aisle space (minimum of 28 in.) to allow the unobstructed movement of emergency equipment and personnel
6. Do no open, handle, or store any container in a manner that will cause it to leak
7. Perform and document weekly CERCLA storage area inspections by qualified personnel.

Personnel trained in the management of a CERCLA waste storage area inspect the temporary storage area weekly. The purpose of the inspections is to evaluate container integrity, verify correct container labeling, and correct any noted deficiency or issue. Inspections are documented on the CERCLA storage area checklist that is maintained within each CERCLA storage area. Management Control Procedure-3475, "Temporary Storage of CERCLA-Generated Waste at the INEEL," will be used as guidance on storage and inspection of each CERCLA storage area. The CERCLA storage area will be signed and access controlled to ensure that no unauthorized access occurs by untrained personnel.

E5. WASTE PACKAGING, LABELING, AND TRANSPORTATION

Containers used to store CERCLA waste must be in good condition, compatible with the waste being stored, and properly labeled. The INEEL Waste Acceptance Criteria (DOE-ID 2002) details the criteria for waste packaging. Containers for the collection of this waste will be clearly labeled to identify waste type and will be maintained inside the work area until removal for subsequent waste management activities. The INEEL Waste Acceptance Criteria report (DOE-ID 2002) also provides guidance to ensure that the containers selected for storage and the method of packaging are compatible with final disposition plans and applicable U.S. Department of Transportation requirements. This will alleviate the need for repackaging the waste before shipment to a treatment or disposal facility.

The types of containers that may be used for storage and transport of waste streams generated during remedial activities include the following:

- Plastic bags
- 19-L (5-gal) open-head drums and/or 208-L (55-gal) open-head drums
- 4 × 4 × 8-ft metal waste boxes (or equivalent)
- Roll-off containers lined with burrito bags
- End-load dump trucks.

Roll-off containers lined with burrito bags will be used for soil and other solid waste intended for direct disposal in the ICDF landfill or CFA Landfill Complex. End-load dump trucks may be used for waste requiring storage in the ICDF bulk storage area pending treatment required to meet the land disposal restrictions before disposal in the ICDF landfill. Bags, drums, and waste boxes may be used for other solid waste types pending direct disposal or treatment, as required (e.g., construction debris, PPE, or sampling waste). All waste will be containerized in compliance with the facilities' waste acceptance criteria, based on specific storage, treatment, and disposal requirements at the receiving facility. The packaging is intended to protect against contaminant migration and environmental degradation. Low-volume contaminated waste associated with activities may be bagged, taped, and labeled. To reduce the number of separate bags, similar waste may be combined and accounted for in one bag and/or container in consultation with WGS personnel. During site activities, the workers will transport this bagged material in a protective manner (i.e., containment of the material is maintained). The waste may be either directly transported to the disposal facility or accumulated in a container (or containers) at the CERCLA storage area already established at CFA and will be managed pending approval and transport to its final disposition path.

Containers will be marked and labeled appropriately to match the designation established for each waste stream. Radiation labels shall be placed on containers as required by the *INEEL Radiological Control Manual*. Uncontaminated waste will be placed in containers marked as "Cold Waste." Containers will be marked with labels identifying them as "CERCLA Waste" if contaminated or as "Cold Waste" if uncontaminated.

Standard green and yellow CERCLA waste labels shall include appropriate information on the waste packaging, as follows:

- The accumulation start date
- Name of generating facility (e.g., OU 4-13)
- Waste description
- Phone number of generator contact
- Listed or characteristic waste code(s), if applicable.

Other labels and markings may include, as applicable:

- Toxic Substances Control Act waste labels/markings

- Waste package gross weight
- U.S. Department of Transportation markings/labels
- Maximum radiation level on contact and at 1 m (3.3 ft) from the container
- Waste stream or material identification number as assigned by WGS
- Other labels and markings as required by 49 CFR 172 Subparts D and E.

Figure E-1 provides an example of a CERCLA waste label. A unique bar code serial number from the INEEL IWTS also will be placed on the container to facilitate management. The boxes and containers shall, at a minimum, be labeled on one side with the "CERCLA Waste" label and the IWTS sticker (visible side labeled) prior to transportation.

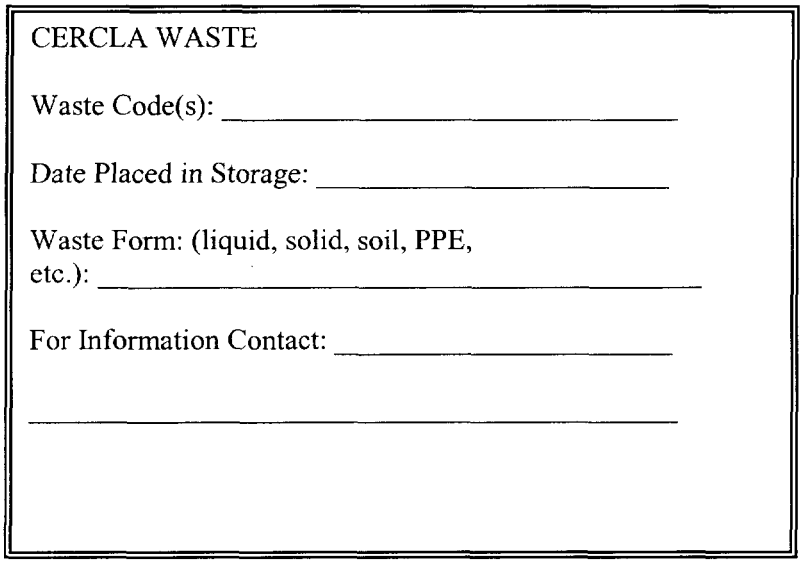

Figure E-1. Example of a Comprehensive Environmental Response, Compensation, and Liability Act waste label.

Any of the above information that is not known when the waste is labeled may be added when the information becomes available. The WGS will provide the unique bar codes and serial numbers. A new bar code will be affixed to each container when waste is first placed in the container. In addition, waste labels must be visible, legibly printed or stenciled, and placed so that a full set of labels and markings are readily visible.

Packaging and labeling for transportation shall meet U.S. Department of Transportation requirements, as appropriate. Packaging exceptions to the U.S. Department of Transportation requirements that are documented and provide an equivalent degree of safety during transportation may be used for on-Site waste shipments. Containers will be labeled and marked appropriately to match the designation established for each waste stream.

E6. WASTE MINIMIZATION AND SEGREGATION

Waste minimization techniques will be incorporated primarily through design, planning, and efficient operations. Specific waste minimization practices to be implemented during the project will include, but not be limited to:

- Excluding materials that could become hazardous waste in the decontamination process (if any)
- Controlling transfer between clean and contaminated zones
- Designing containment such that spread of contamination is minimized
- Deploying appropriate decontamination methods.

Reuse and recycling opportunities also will be evaluated for waste, such as batteries, scrap metal, and equipment or materials that are no longer needed. Uncontaminated equipment that is determined to be excess will be evaluated for reuse by other INEEL projects or government surplus sale.

E7. REFERENCES

40 CFR 243, 2002, "Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste," *Code of Federal Regulations,* Office of the Federal Register, February 2002.

40 CFR 261.3, 2003, "Definition of Hazardous Waste," *Code of Federal Regulations,* Office of the Federal Register, January 2003.

40 CFR 262.11, 2002, "Hazardous Waste Determination," *Code of Federal Regulations,* Office of the Federal Register, February 2002.

40 CFR 264, Subpart I, 2002, "Use and Management of Containers," *Code of Federal Regulations*, Office of the Federal Register, April 2002.

49 CFR 172, Subpart D, 2002, "Marking," *Code of Federal Regulations*, Office of the Federal Register, November 2002.

49 CFR 172, Subpart E, 2002, "Labeling," *Code of Federal Regulations*, Office of the Federal Register, November 2002.

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act (Solid Waste Disposal Act)," *United States Code*, October 21, 1976.

DOE O 435.1, 2001, "Radioactive Waste Management," U.S. Department of Energy, August 28, 2001.

DOE-ID, 2002, *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria*, DOE/ID-01-10381, Revision 16, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, December 2002.

DOE-ID, 2003, *Waste Area Group 4 Remedial Design/Remedial Action Work Plan, CFA-04 Pond Mercury-Contaminated Soils, Operable Unit 4-13,* DOE/ID-11028, Revision 0, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, February 2003.

French, Robert Francis, 2000, *Manual 15A–INEEL Radiological Control Manual*, Revision 6, July 2000.

INEEL, 2002, *Health and Safety Plan for the CFA-04 Mercury Pond Sampling and Remedial Action*, INEEL/EXT-02-00528, Revision 0, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, June 2002.

MCP-62, 2003, "Waste Generator Services—Low-Level Waste Management," Revision 5, *Manual 17–Waste Management*, January 2003.

MCP-63, 1999, "Waste Generator Services—Conditional Industrial Waste Management," Revision 2, *Manual 17–Waste Management*, August 1999.

MCP-70, 2003, "Waste Generator Services—Mixed Low-Level Waste Management," Revision 8, *Manual 17–Waste Management,* January 2003.

MCP-3475, 2002, "Temporary Storage of CERCLA-Generated Waste at the INEEL," Revision 2, *Manual 8–Environmental Protection and Compliance*, April 2002.